MARCH 1, 1945

American Machinist

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TECHNOLOGY DEPT.

Selective Assembly of Cylindrical Parts

•

Electronics Finds Wide Use

•

Selection of Abrasives For Blast Cleaning

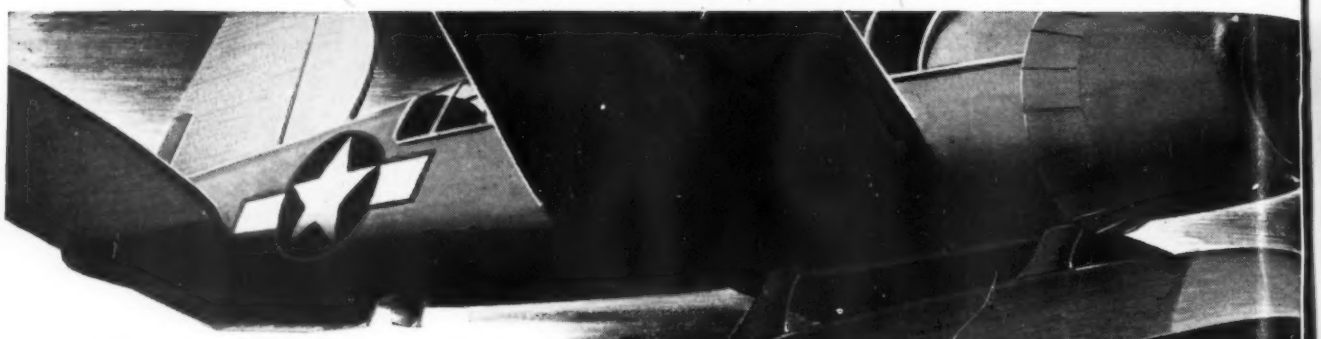
•

Chrome Plating on Piston Rings

Stainless Steels

THEIR PROPERTIES AFFECT WELDING METHODS

R v.89 2 Mar.-Apr. 1945

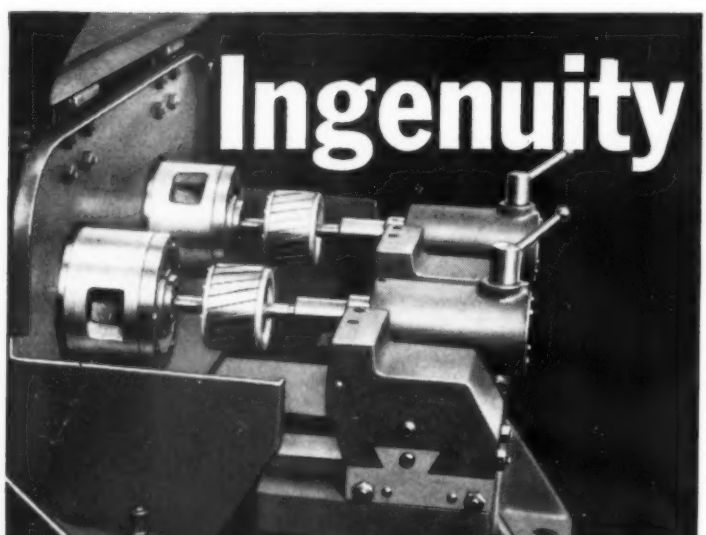


Ingenuity LIKE THIS IS WINNING THE WAR FOR U. S. . . .

Beer Bottles Instead of Bombs

In the early days of Guadalcanal, Jap warships were sneaking in every night to bombard Henderson Field. We had only a handful of PT's and a dozen scout seaplanes to hold them off. The scout planes couldn't attack with bombs — so the boys worked out a scheme.

Next night, our planes spotted the Nip ships and *attacked with empty beer bottles* — knowing that they would whistle down like bombs. This drew the Jap fire. Revealing gun flashes gave our PT boats a perfect target—and they tore in for the kill.



LIKE THIS WILL WIN THE PEACE FOR YOU

In precision finishing electric motor rotors, grinding proved exceedingly troublesome — wheels would quickly load with soft aluminum. Production was only 70 an hour.

Now — precision-turned two at a time on a Heald No. 49 Bore-Matic specially built for the job — rotors are held to 2.500"— 2.501" O. D. concentric with the shaft within .001" total indicator reading, and parallel to .004" in 12". Production 200 an hour!

THE HEALD MACHINE COMPANY
WORCESTER 6, MASS.

HEALD

means more precision faster!

INTERNAL AND SURFACE GRINDING MACHINES
BORE-MATIC PRECISION FINISHING MACHINES

TECHNOLOGY DEPT.

American Machinist

DETROIT

March 1, 1945

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★ New Title or Position _____

American Machinist Chips

This Issue . . . We think you'd like to give the once-over—or perhaps the twice-over—to the following articles in this issue:

First of a series on the welding of stainless steel—one of the outstanding developments of the past few years; article on the use of abrasives for blast cleaning; 8-page major article on die control.

Next Issue . . . Regardless of the progress of the war and of the corresponding fluctuation in reconversion thinking, the problems of contract termination seem to be always with us these days.

Accordingly, a special section in the March 15 issue of *American Machinist* will cover the following subjects:

How Studebaker handles pre-determination; a chart story on surplus property disposal, giving practical answers for business men; some information on "partial payments"; how Sperry Gyroscope has organized a "spark plug" unit to speed termination procedure.

There should be a lot of meat in this material for every Metal-Working executive who now faces or expects to face problems of contract termination.

1945 Inventory . . . Burnham Finney, Editor and Publisher of *American Machinist*, wishes to thank the hundreds of firms who have already returned completed questionnaires on our traditional 5-year Inventory of Metal-Working Equipment. Due to the great number of replies received, it is impossible to write each respondent individually, so please consider this a blanket "thank you."

Typical of replies received are these:

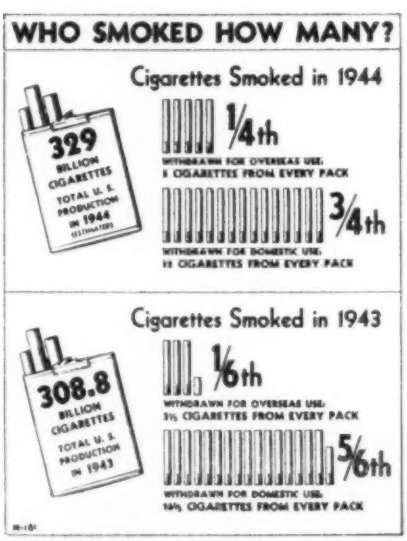
"We have all kinds of problems these days which take up every working minute, but nevertheless we think your Inventory of Metal-Working Equipment is a project which deserves priority. Therefore, we will complete the inventory and return it to you just as soon as we can, consistent with doing a good job—probably within the next two weeks." O. D. Reich, V.P., Dexter Folder Co., Pearl River, N. J.

"In response to your recent request, we take pleasure in submitting to you for your 5-Year Inventory of Metal-Working Equipment the figures applicable to our plant. You are doing a splendid work in continuing this periodic survey and we shall look forward with keenest interest to seeing the results of your study. Let us know if we can be of further service." Frederick S. Blackall, Jr., President & Treasurer, The Taft-Peirce Mfg. Co., Woonsocket, R. I.

If you, Mr. Reader, have received a copy of this questionnaire to fill out for your plant, we will certainly appreciate your cooperation. WPB, ordnance heads and private manufacturers throughout industry have enthusiastically endorsed the compilation of this Inventory, and we sincerely believe you can help yourself and all Metal-Working by giving us data on machines and equipment in your plant.

Cigarette Facts . . . We still don't know who's getting all the "coffin nails," but we were rather interested in the chart shown here reproduced from a recent issue of *Domestic Commerce*. Contrary to popular conception, the boys overseas are *not* smoking the bulk of cigarettes—only ¼ of the total production in 1944.

Any information as to the whereabouts of just a few packs of the other billions will be appreciated by ye editor of *Chips*.


WHO SMOKED HOW MANY?
Cigarettes Smoked in 1944
329 BILLION CIGARETTES TOTAL U. S. PRODUCTION IN 1944
1/4th
WITHDRAWN FOR OVERSEAS USE: 5 CIGARETTES FROM EVERY PACK
3/4th
WITHDRAWN FOR DOMESTIC USE: 15 CIGARETTES FROM EVERY PACK
Cigarettes Smoked in 1943
308.8 BILLION CIGARETTES TOTAL U. S. PRODUCTION IN 1943
1/6th
WITHDRAWN FOR OVERSEAS USE: 3½ CIGARETTES FROM EVERY PACK
5/6th
WITHDRAWN FOR DOMESTIC USE: 16½ CIGARETTES FROM EVERY PACK

New Building . . . Despatch Oven Company of Minneapolis advises us of the completion of their new office building. It provides 5600 square feet on one floor, plus basement. It is windowless, insulated, air-conditioned; all-in-all, it must be quite a place. Congratulations, Despatch.

Golden Request . . . Continuing what seems to be developing into a series of foreign comments, we have a letter from far-off Eritrea (on the East Coast of Africa, facing the Red Sea) asking for information on metal-working equipment. Although it is not our custom to

use this column for classified ads, in the interest of spreading Metal-Working throughout the world we are quoting this letter in the event that some of you may want to correspond with this firm:

"Sir: We would like to develop here in Eritrea a small industry for the working up of gold, like small chains, cigarette cases, medals and small medals, etc.

"We are therefore applying to you asking to kindly let us have the address of different firms who manufacture the necessary machineries.

"It would be better if by return of post we shall be able to get catalogues and prices. We are, Sir, yours faithfullies, Ditta, Cataldo & Mancini, Piazza Tribunale 12—Asmara (Eritrea)."

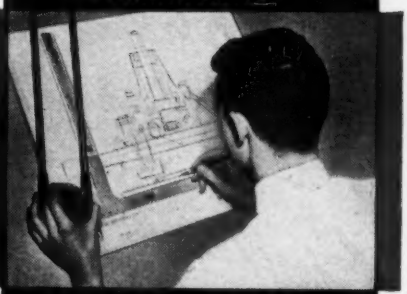
Britain At War . . . As was noted in this column and elsewhere in *American Machinist* some time ago, Burnham Finney recently returned from a trip to England—as a guest of the British Government—to observe war activity and reconversion planning as it affects Britain's Metal-Working industry. Burnham has given a series of talks on his experiences—one of which you may have attended. If not, this is to advise you that a printed resumé of his talk has been prepared, and a limited number of copies are available.

We will be glad to send you a copy if you'll write us. It's first come, first served, and we believe you'll find this picture of British industry at war not only very interesting but very informative. Address *"Chips, American Machinist*, 330 W. 42 St., New York 18, N. Y."

to help you

1 SOLVE BEVEL GEAR DESIGN PROBLEMS

BEVEL GEAR DESIGN ENGINEERING

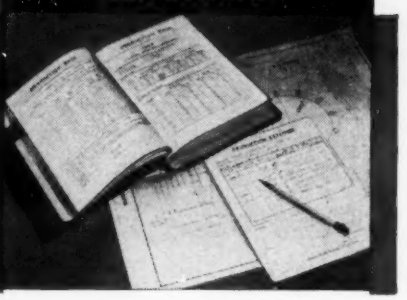


2 OBTAIN THE RIGHT EQUIPMENT FOR YOUR NEEDS

BEVEL GEAR EQUIPMENT ENGINEERING

3 ESTIMATE YOUR PRODUCTION TIME AND COSTS

BEVEL GEAR PRODUCTION ENGINEERING



the COMPLETE Gleason Engineering Service . . .

. . . when you have a problem involving bevel gear design or production, the solution can be secured from the Gleason Works—without obligation. Highly skilled engineers, backed by the company's *80 years' experience* in designing bevel gears and building bevel gear machinery, will study your bevel gear drive designs. Profitable improvements are often suggested. Correct gear cutting machines, tools and auxiliary equipment to meet your specific manufacturing requirements will be recommended. Further, we'll prepare for you estimates of production time, based upon actual shop practice. By utilizing this complete service you can save time and money.

WHAT WE NEED to help you

FOR PRODUCTION ENGINEERING

1. Blueprints of your bevel gear designs.
2. Material specifications and manufacturing tolerances.
3. Quantity of gears to be produced per month.
4. Number of working hours per month available for gear production.

FOR DESIGN ENGINEERING

1. Preliminary layouts or prints of proposed bevel gear drive designs.
2. Type of drive.
3. Horsepower and speed required.
4. Type of loading (constant, intermittent or shock).
5. Driving member and direction of rotation.

For informative literature on the design, manufacture and application of straight, spiral and Zerol bevel and hypoid gears, write on your firm's letterhead.

GLEASON

GLEASON WORKS

Builders of Bevel Gear Machinery for Eighty Years

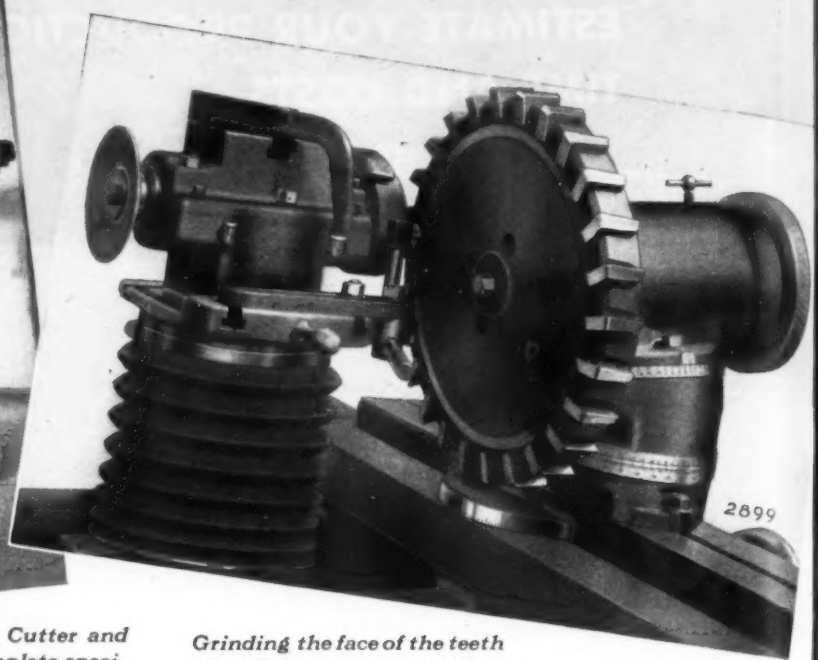
1000 UNIVERSITY AVENUE, ROCHESTER 3, N. Y., U. S. A.

"For all around tool and cutter grinding— Cincinnati #2 tool and cutter grinder is the machine"

The above heading is an excerpt from a letter we received January 5, 1945 from a cutter grinder craftsman in a western city.

This machine has the capacity and versatility of adjustments for grinding a wide range of sizes and types of cutters. Two extremes are illustrated on these pages. The grinding operation on the pencil sharpener cutter (right) shows an ingenious setup for a small cutter, while the face mill and attachment (below) is proof of the machine's capacity and ability to support a heavy load, yet the table can be moved with a light push of the finger. ¶ Cutter sharpening men *like* this machine because it's so convenient to operate; the handy controls and adjustments enable them to do many sharpening jobs 15% to 25% faster. We'll be glad to send more information about the versatility and usefulness of the CINCINNATI No. 2 Cutter and Tool Grinder.

CINCINNATI *No. 2 Cutter and Tool Grinder. Complete specifications may be obtained by writing for Catalog M-962-2.*



Grinding the face of the teeth of a 16" diameter face milling cutter with the aid of the Face Mill Grinding Attachment.

Keep on buying WAR BONDS

THE CINCINNATI MI

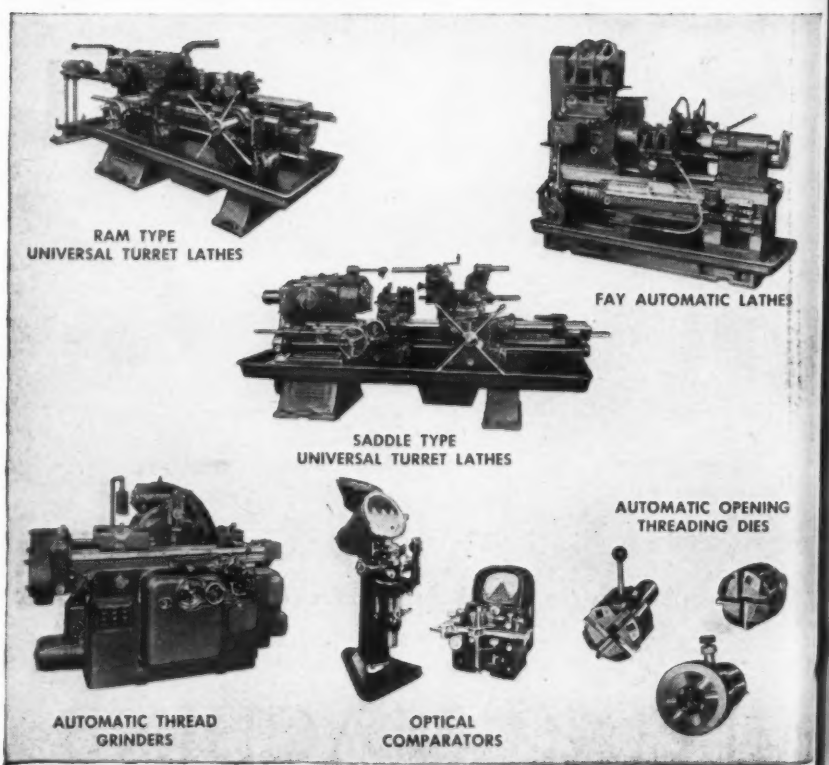
MILLING MACHINES

Sharpening a pencil sharpener cutter. Front view. Top illustration shows rear view.

MILLING MACHINE CO. CINCINNATI 9, OHIO, U. S. A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

How many hands does a turret lathe operator need?



JONES & LAMSON

MACHINE COMPANY

SPRINGFIELD, VERMONT, U. S. A.

Manufacturers of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.

Many a turret lathe operator must have wished, at times, that he were like the six-armed deity of the Hindus, for faster-cutting tools have greatly increased the productivity of these machines and the burden upon the operator. The necessity for simplified controls to save waste motion and operator fatigue is, therefore, imperative!

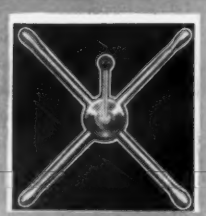
Jones & Lamson Universal Turret Lathes are designed not only to take full advantage of the fastest-cutting tools, but also to give every mechanical aid to the operator so that he can operate to the maximum capacity of the machine without undue fatigue.

We show here some of the man-saving, time-saving features built into these machines. Write to us for more detailed information and descriptive literature.

—— only two --- if it's a Jones & Lamson

SINGLE LEVER SPINDLE SPEED SELECTOR

With direct reading dial, to control all spindle speeds. Next speed pre-selected while cut is in progress.

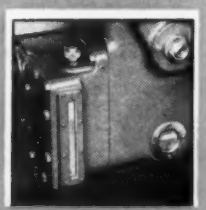


POWER TRAVERSE AND INDEXING OF THE HEXAGON TURRET

Turret of saddle type machines is power traversed and power indexed. A time saver and man saver too.

SINGLE LEVER FEED SELECTORS

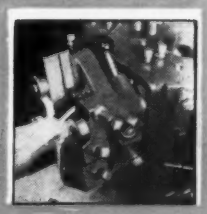
Controlled by single lever, direct reading, selectors. Feeds pre-selected while cut is in progress.



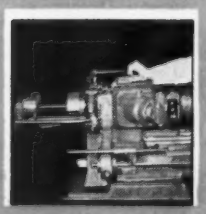
AUTOMATIC LUBRICATION SYSTEM

Requires minimum of attention. Flow of lubricant automatically increases as spindle speed increases.

AUTOMATIC COOLANT SUPPLY TO HEXAGON TURRET



A copious supply of coolant is pumped automatically to the working face of the hexagon turret.

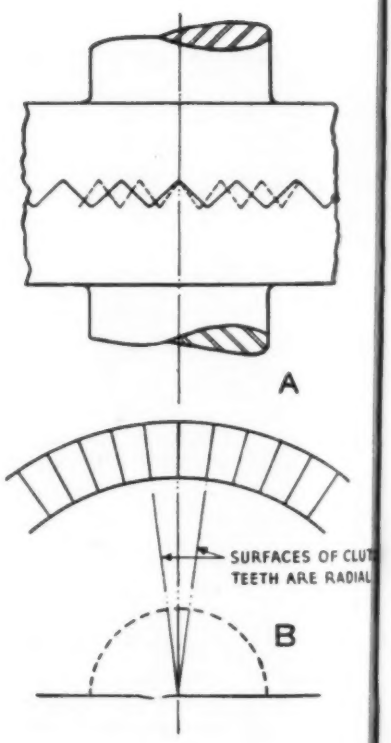


SIMPLIFIED BAR FEED AND COLLET OPERATING MECHANISM

Operated by a single lever, which opens chuck, feeds in stock and closes chuck.

All these features and many others are incorporated as standard in Jones & Lamson Universal Turret Lathes.

A GEAR-TYPE FACE CLUTCH



The essential fact which makes this difficult operation successful, is that the center line of the cutting tool is offset from the axis of the work, so as to bring the contact point of the tool directly over the center line of the work. The cutter-spindle carrying the single-point cutting tool is reciprocated, but does not rotate. At C and D, the cutting tool is advanced by the cam to generate the helicoidal surface *b*. At E and F, the tool travels in the opposite direction to generate the tooth face *e*. Arrows *a*, *c*, *d* and *f* indicate points of contact of cutting tool with work in various positions. B is a projection of the teeth at A, and shows that all elements on the sides of the teeth are radial with the axis of the work.

THE FELLOWS METHOD... MACHINES AND TOOLS FOR

WITH TEETH HAVING

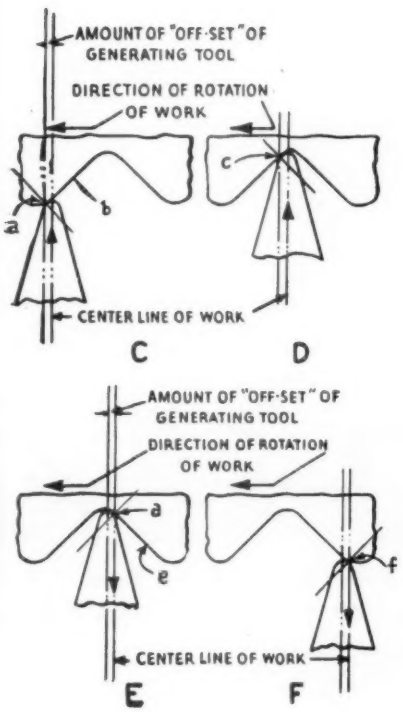
TRUE Helicoidal SURFACES

★ **Cut on Fellows Gear Shaper equipped with a Face Gear cutting attachment**

Here is still further evidence of Fellows Gear Shaper's cost-saving versatility.

The problem: to generate the tooth members of a gear-type face clutch, the teeth on both members of which must be in intimate contact over their entire helicoidal surfaces.

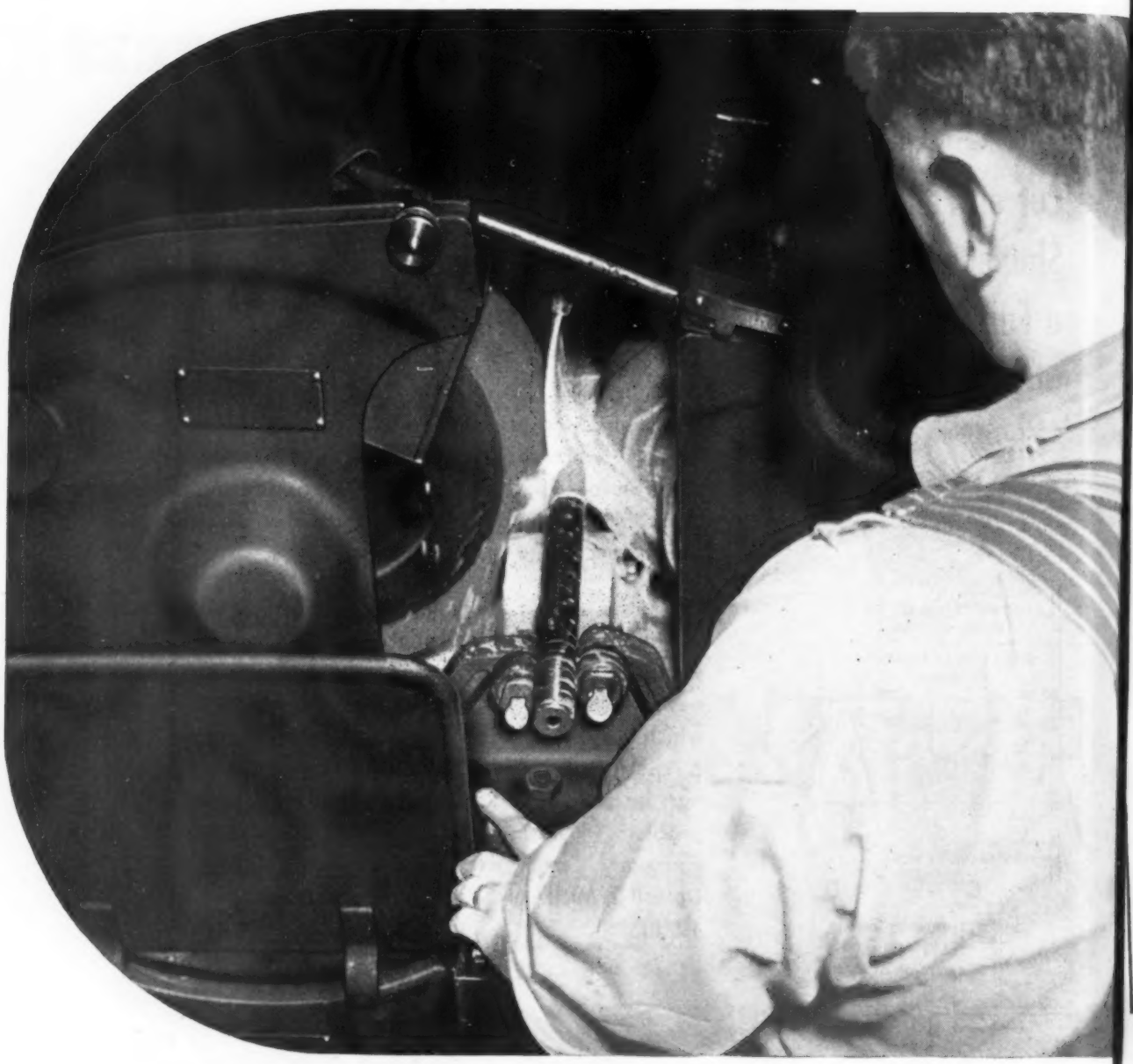
The solution: a special work-holding attachment and depth feed mechanism attached to a regular Fellows Gear Shaper. The job is done to precision standards, in faster time and at lower costs than could be accomplished with a special-purpose machine!



This job is one of many "extras" performed successfully by the Fellows Method. Today, Fellows Gear Shapers in your plant may be so busy on volume runs that you may never have had occasion to learn of the other work which it will do beside cutting gears. Next time you have a "special assignment", consult Fellows engineers . . . it may be that your Gear Shaper will be the solution to your problem. Write for literature. The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Bldg., Detroit 2, Mich., or 640 West Town Office Bldg., Chicago 12, Ill.

Fellows

ALL OPERATIONS FROM BLANK TO FINISHED GEAR



This illustration shows clearly the function of the Roller Infeed Work Rest. The setup is on a CINCINNATI No. 2 Centerless, grinding both ends of tank tread links.

Keep on buying
WAR BONDS

CINCINNATI

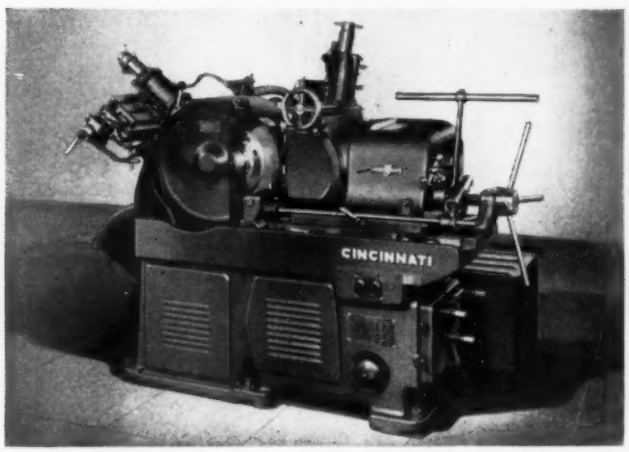
CENTER TYPE GRINDING MACHINES

ROLLER INFEED WORK REST *takes care of parts*

THAT EXTEND BEYOND THE WHEELS

CINCINNATI

The centerless method of grinding can readily be applied to long parts, up to 55" in length, which require a ground diameter on one or both ends. CINCINNATI engineered Roller Infeed Work Rests solve the problem nicely. While one end of the work is being ground between the wheels, the other end is supported in exact alignment by rollers. ¶ The shape of the part between the ground diameters imposes little or no restrictions on the application to centerless grinding. It can be a commonplace straight diameter, like the tank tread link in the large illustration at the left. It can have a projecting section such as a clutch release fork, or an enlarged section like a "banjo" housing. In any event, Roller Infeed Work Rests simplify and speed up the grinding of parts which, at first glance, may not look like good centerless jobs. ¶ Perhaps many parts in your own shop could be ground more quickly and accurately on a CINCINNATI Centerless with Roller Infeed Work Rest. The engineers here at Grinding Headquarters will be glad to discuss this phase of grinding with you.



CINCINNATI *No. 2 Centerless Grinding Machine. Complete specifications may be obtained by writing for Catalog M-456-3. For a brief description look in Sweet's Catalog File for Mechanical Industries.*

GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

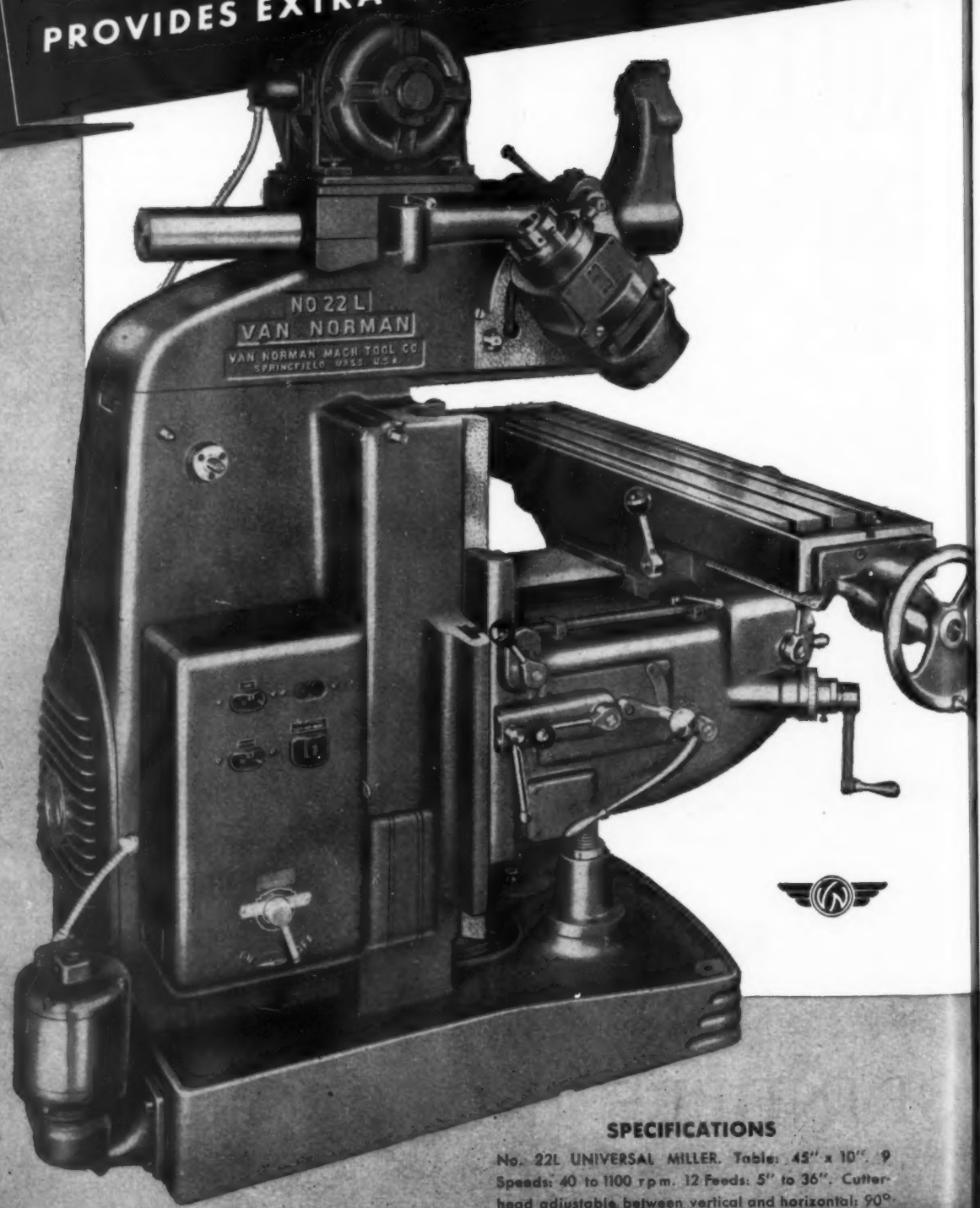
CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

VERSATILE CUTTERHEAD..

SAVES WORK RESET-UPS

SIMPLIFIED CONTROL..

PROVIDES EXTRA OPERATING CONVENIENCE



SPECIFICATIONS

No. 22L UNIVERSAL MILLER. Table: 45" x 10". 9 Speeds: 40 to 1100 r.p.m. 12 Feeds: 5" to 36". Cutterhead adjustable between vertical and horizontal: 90°.

..on VAN NORMAN Universal Millers

The versatile cutterhead on Van Norman Ram Type Universal Millers gives you vertical, horizontal or angular milling by simply swinging the cutterhead to the desired milling position. Thus in one compact machine you have the range of several types of millers.

This Van Norman feature enables operators to complete most milling operations on a workpiece without resetting the work. In addition, there is no waiting for other types of millers to become available. The valuable time saved often increases the productive output of the machine and operator by as much as 50%. (note the typical milling applications shown below)

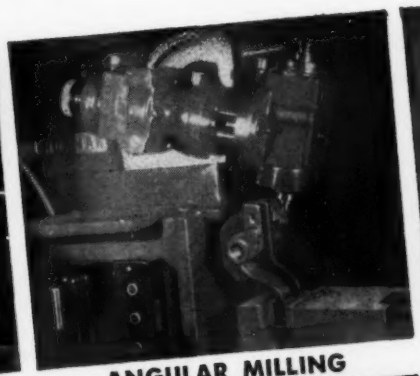
The adjustable cutterhead...combined with front and rear directional control of all power feeds for the table, knee, saddle, as well as 6-way rapid traverse... quick-change speed and feed selectors conveniently located for easy reach by the operator... and other important Van Norman Features which assure accuracy, economy and top production.

"It pays to Van Normanize"

VAN NORMAN COMPANY

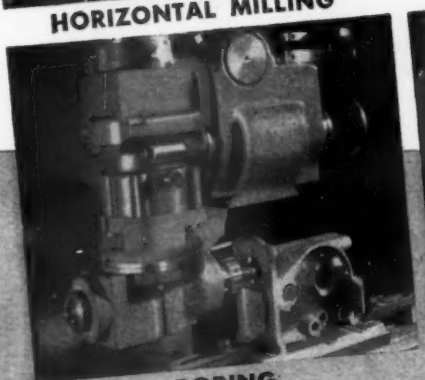
SPRINGFIELD 7, MASSACHUSETTS

HORIZONTAL MILLING



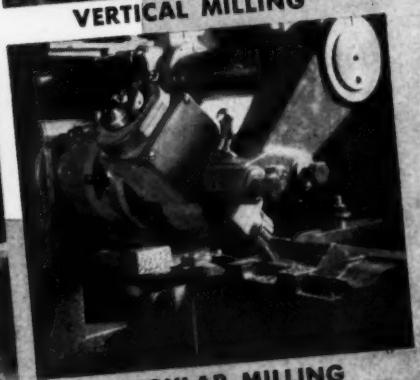
ANGULAR MILLING

VERTICAL MILLING



BORING

SLOTTING



ANGULAR MILLING with sub head

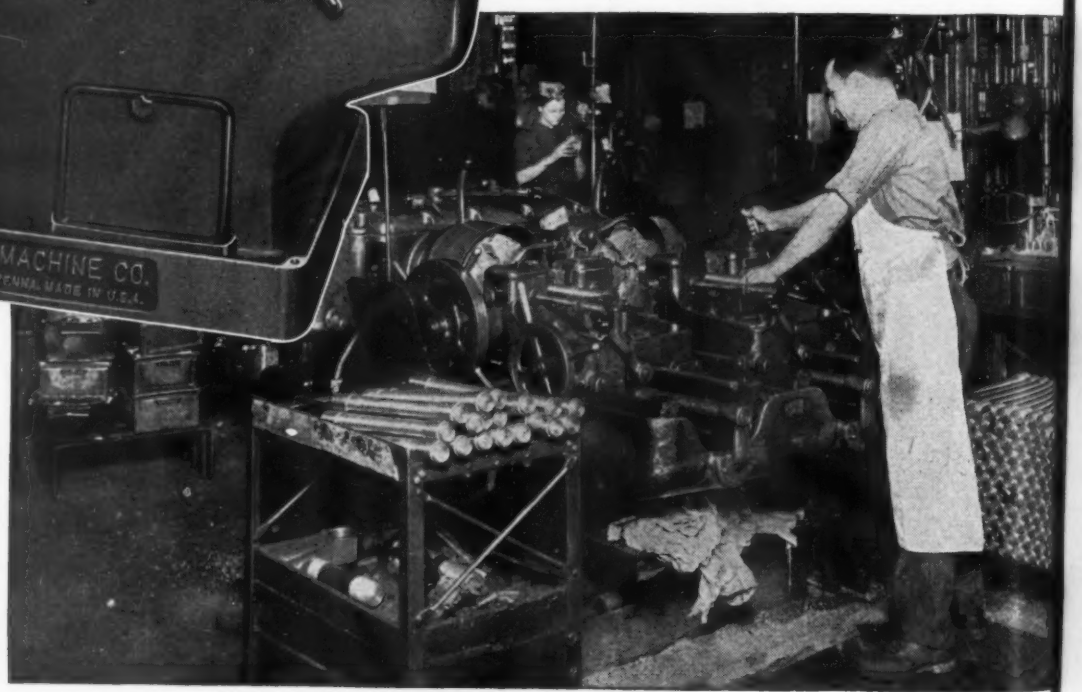
THE LANDMACO *Threading Machine*

Assures the Fine Threading Accuracy Required for Diesel Engine Studs

Cylinder Head Studs of the Diesel Engine are made from heat-treated alloy steel and present a difficult threading operation. The threads must be held to extremely close tolerance specifications.

Manufacturers of these parts using Landmaco Threading Machines have no difficulty in meeting the specifications.

To the left is shown the Double Head Landmaco Threading Machine. Below, the same machine in operation, threading Diesel Engine Studs.



Write for Bulletin H-75

LANDIS MACHINE COMPANY

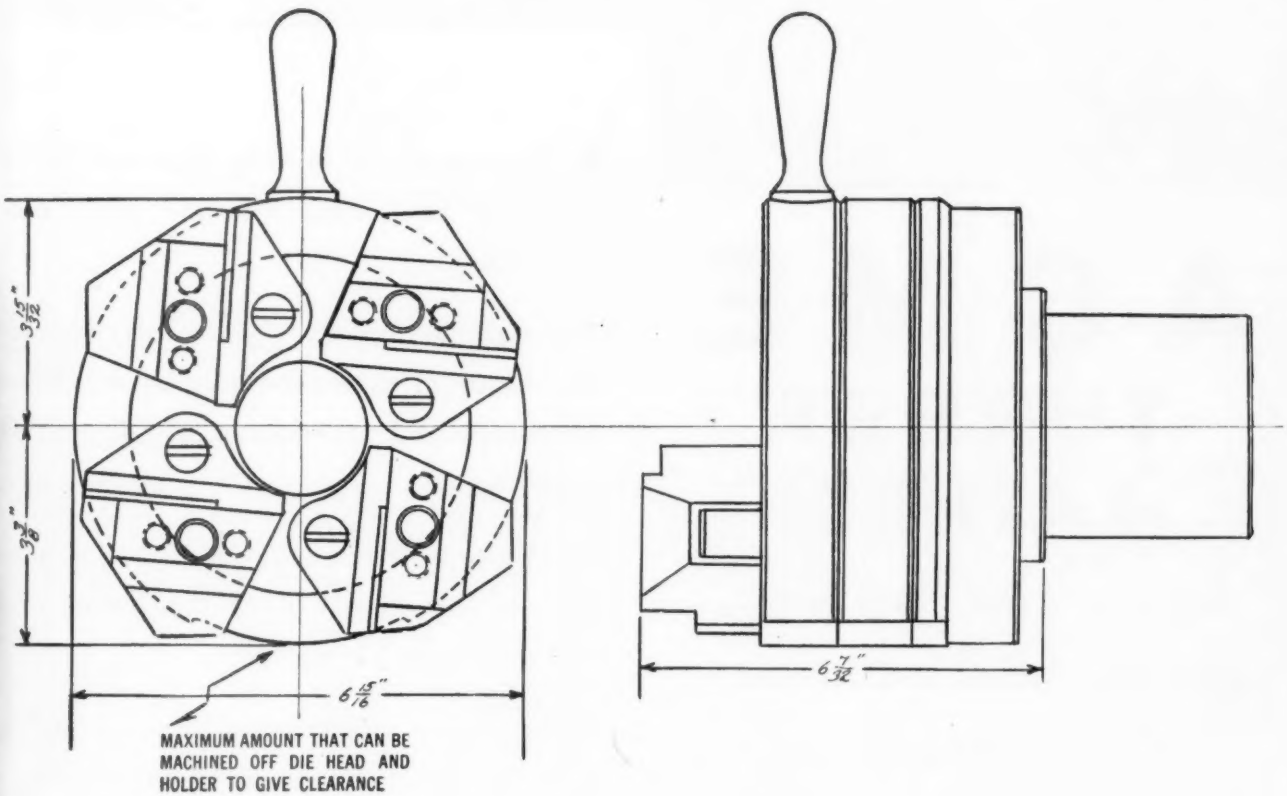
A Good Mechanic Knows and Cares For His Machine

LANDIS REG. U.S. TRADE-MARK PAT. OFF. THREAD TIPS

In the Interest of Efficiency, Better Workmanship and Higher Production

2" F TYPE LANDMATIC DIE HEAD WITH RINGS AND HOLDER MACHINED OFF TO CLEAR 3 3/8" FROM CENTER

FOR ATTACHING TO A #5 W&S TURRET LATHE & 4 B GISHOLT



Landmatic Heads, when applied to certain turret lathes, may be slightly too large to permit swinging the head over the machine saddle.
The illustration shows how the lower side of the head may be machined to insure proper clearance.

Be Threadwise — Employ LANDIS Long Life Tangential Chasers

WAYNESBORO, PENNSYLVANIA, U.S.A.

THREADING MACHINERY—THREAD CUTTING DIE HEADS—COLLAPSIBLE TAPS

ACME TURRET LATHES

have the power, speed and accuracy for machining precision parts for CARLTON Radials

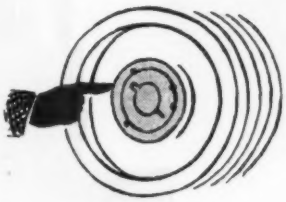
● Illustrated is a battery of Acme Turret Lathes at the Carlton Machine Tool Company plant.

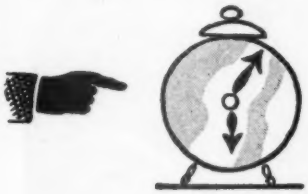
The multiple tooling—rigidity of construction—ease of operation insures maximum production and dependable precision on all operations.

This battery of Acme Turret Lathes is handling a wide variety of turning, boring and similar precision operations.

If you have turret lathe work requiring special tooling, it will pay you to investigate Acme. Their long experience in "licking tough jobs" will be helpful to you in reducing costs and boosting production.

...The ACME MACHINE TOOL CO. ...CINCINNATI 32, OHIO.

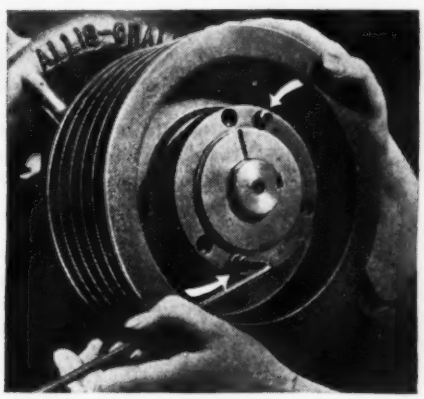
This  Saves:



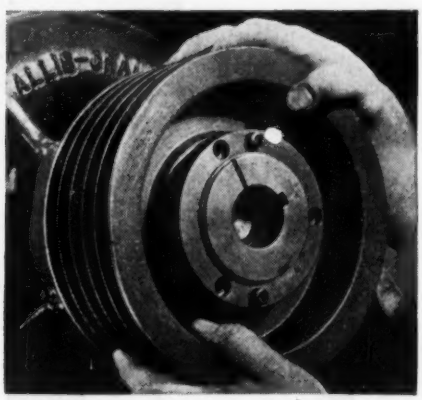
and

Yes, you save all three — time, money, trouble — with Allis-Chalmers' new "Magic-Grip" . . . *fastest mounting and demounting sheave on the market.* Three easy steps do it!

1 **Remove three capscrews** from bushing collar. A handy wrench — supplied with each sheave — is the only tool needed to remove Allis-Chalmers' new "Magic-Grip" from motor or machine shaft quickly and easily.



2 **Insert two capscrews** in tapped holes. As screws are turned, they become levers . . . automatically breaking tight grip of tapered split bushing on sheave and shaft. Entire unit is then ready for removal.



3 **Remove sheave from shaft.** Requires no mallet, no prying, no bulging muscles. You just slide the sheave off . . . smoothly, quickly. *It costs nothing extra!* Send for B6310 Allis-Chalmers, Milwaukee 1, Wis.

A 1760

Allis-Chalmers Texrope

"MAGIC-GRIP" SHEAVES

DETROIT PUBLIC LIBRARY

Landis Tool No. 12 Centerless Grinding Machine. The outstanding leader not only in attractive external appearance, but also in design and performance.

Regulating wheel and grinding wheel are each a self-contained, enclosed unit mounted on separate bases, individually adjustable.

Clean, modern lines at sides and back too. Hinged covers and doors permit easy access to all operating parts for inspection and maintenance.

LANDIS TOOL

Precision Grinders

LANDIS TOOL COMPANY

LANDIS NO. 12 CENTERLESS GRINDER

LEADS IN APPEARANCE

What Good Appearance Means in Performance

"Why," you ask, "talk about the best looking centerless grinder when performance is what counts?"

One look at the clean, compact design and smooth lines tells you that the Landis Tool No. 12 Centerless is new and modern. The design represents an entirely fresh concept of centerless grinding which includes all the latest features for maximum operator output plus closest tolerances.

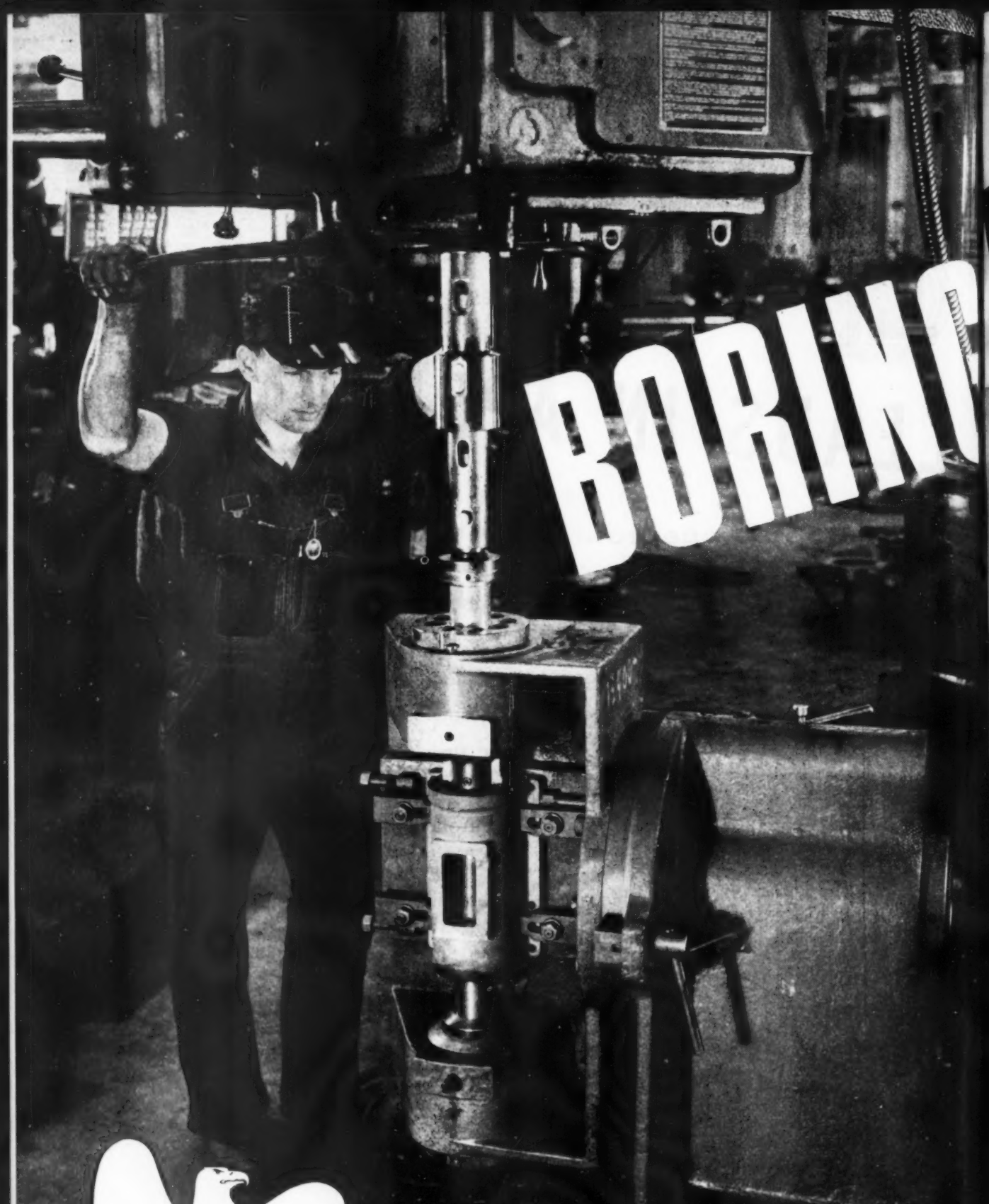
The grinding wheel and the regulating wheel are designed for the first time as individual units mounted on separate bases. This permits enclosure of each for safety and best appearance. The weight of driving motors mounted directly on the bases gives a wheel rigidity which results in better, smoother finishes.

The separate wheel bases simplify the adjustment and control of both wheels by the operator. All grinding and dressing operations are hydraulically or electrically controlled, thereby eliminating cut and try. Furthermore, controls are conveniently grouped for speedy operation. 21

For full information on the many other modern design features, ask for Catalog T44

LANDIS TOOL Company

WAYNESBORO, PA.



THE AMERICAN TOOL WORKS CO

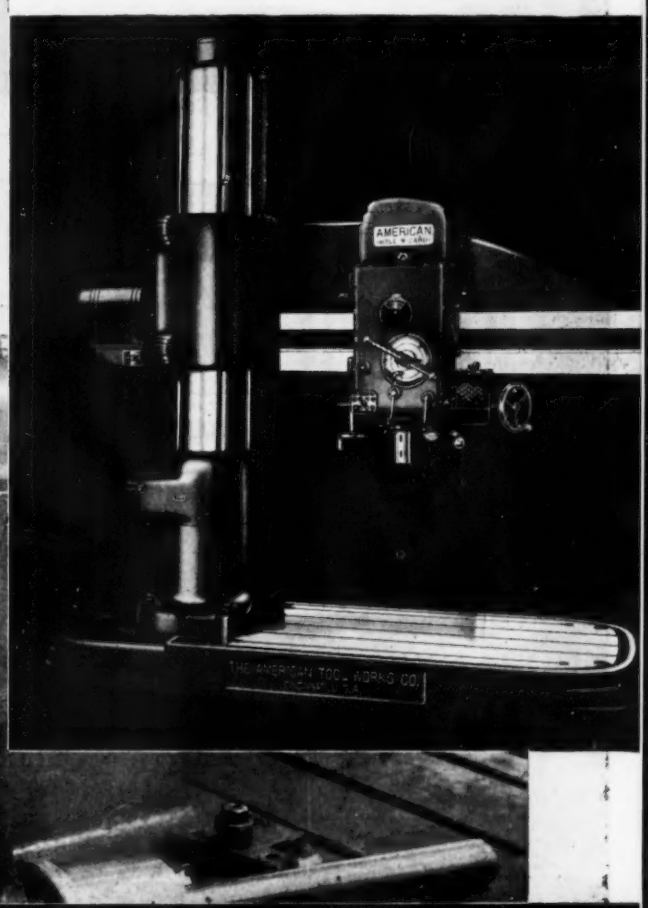
TECHNIQUE...

"American" Hole Wizard Radials are excellent boring machines.

These illustrations show the "American" Hole Wizard Radial boring 40 mm anti-aircraft gun worm housings through a two station jig mounted on an indexing trunnion stand.

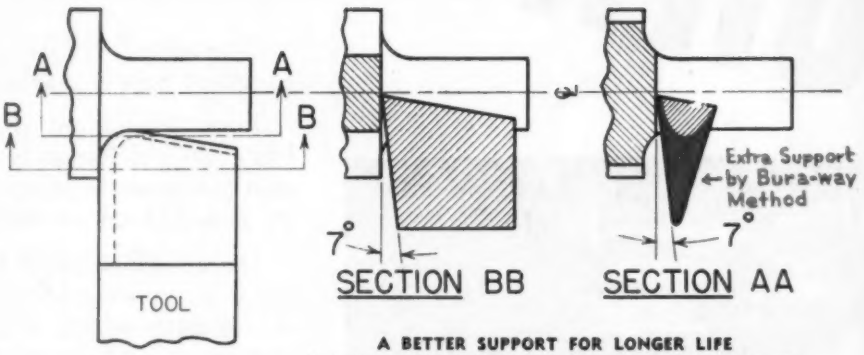
The use of indexing trunnion stands brings the work to a comfortable working height for the operator which seldom is the case when stationary, base mounted jigs are employed, thus conserving the operator's energy and prolonging his efficiency.

For additional advantages offered by the combination of "American" Hole Wizard Radials and indexing trunnion stands, write for Bulletin No. 458.



Lathes and Radial Drills **Cincinnati, Ohio U.S.A.**

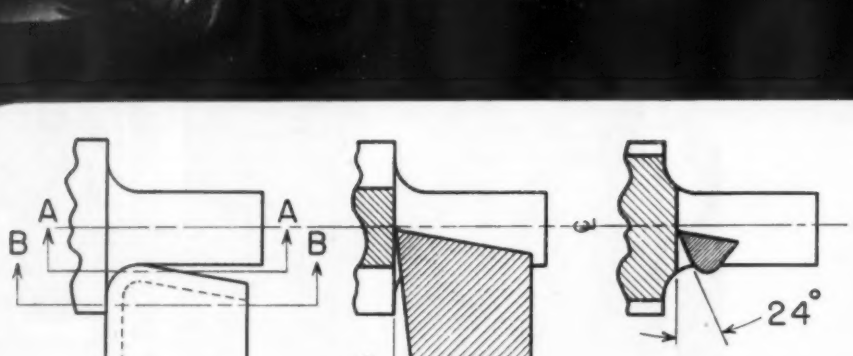
The NORTON BURA-WAY



A BETTER SUPPORT FOR LONGER LIFE

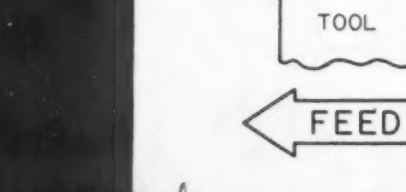
A tool ground the Bura-way has constant relief in the direction of feed, and uniform support under the cutting edge at all sections, including the radius. It has the greatest support and greatest capacity for heat dissipation. Note the clearance angle remains constant at 7° and in addition the large amount of stock supporting the cutting edge as shown by Section AA.

THE NORTON BURA-WAY



EXCESS RELIEF IN DIRECTION OF FEED

Ground in the conventional manner, this same tool has three times the relief, in the direction of feed, at the corner radius, as indicated by parallel sections at AA and BB. For this reason, section AA is the well known breakdown point of this tool. It is here that the tool is buried deepest in the work and should have the greatest support and most material for heat dissipation whereas actually it has the least support and the least material.



THE OLD WAY

NORTON GRINDERS
and Lappers

METHOD IS *DIFFERENT*

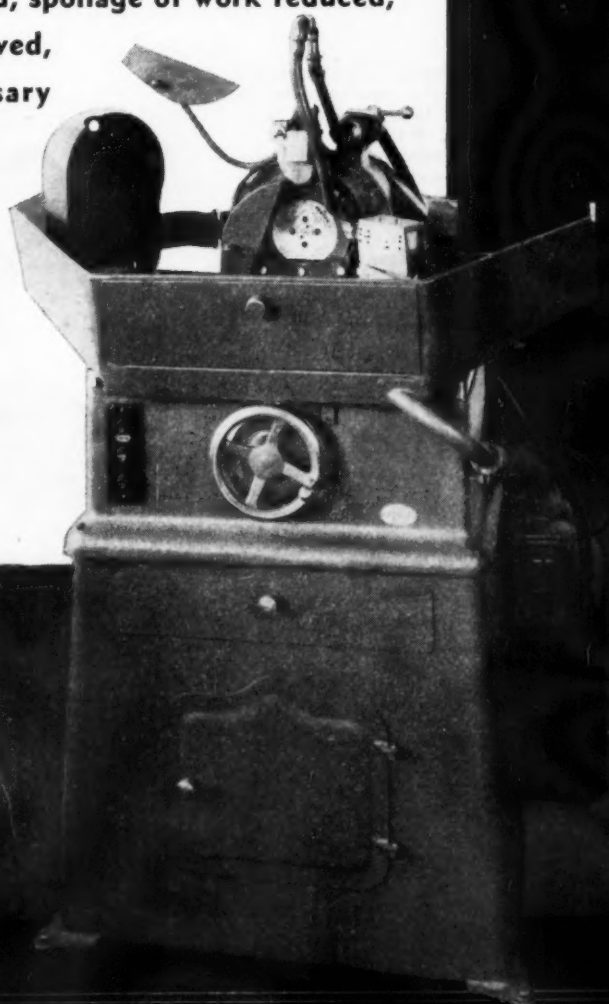
The difference is obvious to any progressive tool designer — as different as the horse for transportation and the 1945 speedy fighter plane which, incidentally, Norton Bura-way ground tools are helping to turn out faster and better.

The Norton Bura-way Grinder is more than an exceptionally well-designed machine for the precision grinding of single-point cutting tools. The Bura-way method — *grinding constant relief in the direction of feed* — provides the means of greatly increasing tool life. Hence your machine output is raised, spoilage of work reduced, and scarce tool steels conserved, thus eliminating unnecessary waste that by other methods has been unavoidable.

Complete information on the Norton Bura-way Grinder on request — no obligation.

NORTON COMPANY
WORCESTER 6, MASS.

M-497

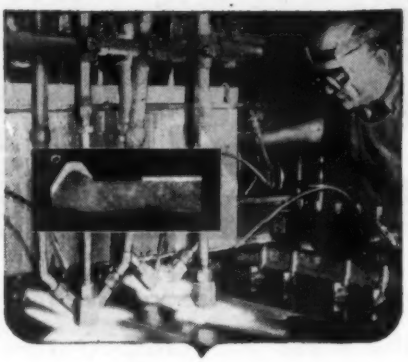


A Norton Bura-way user says: "Our experience so far with the Bura-way machine has shown approximately 30 percent savings in man-hours in our grinding department and has increased our precision control of single-point tools to a place where our rejections have almost disappeared."

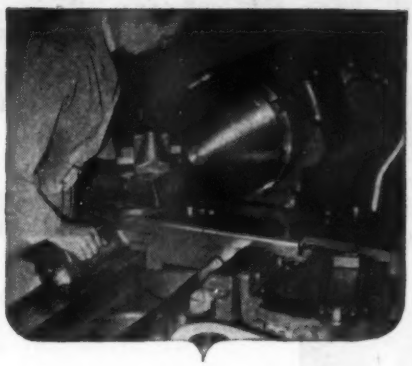
THESE

Monarch Features

MEAN BETTER PRODUCTS AT LOWER COST



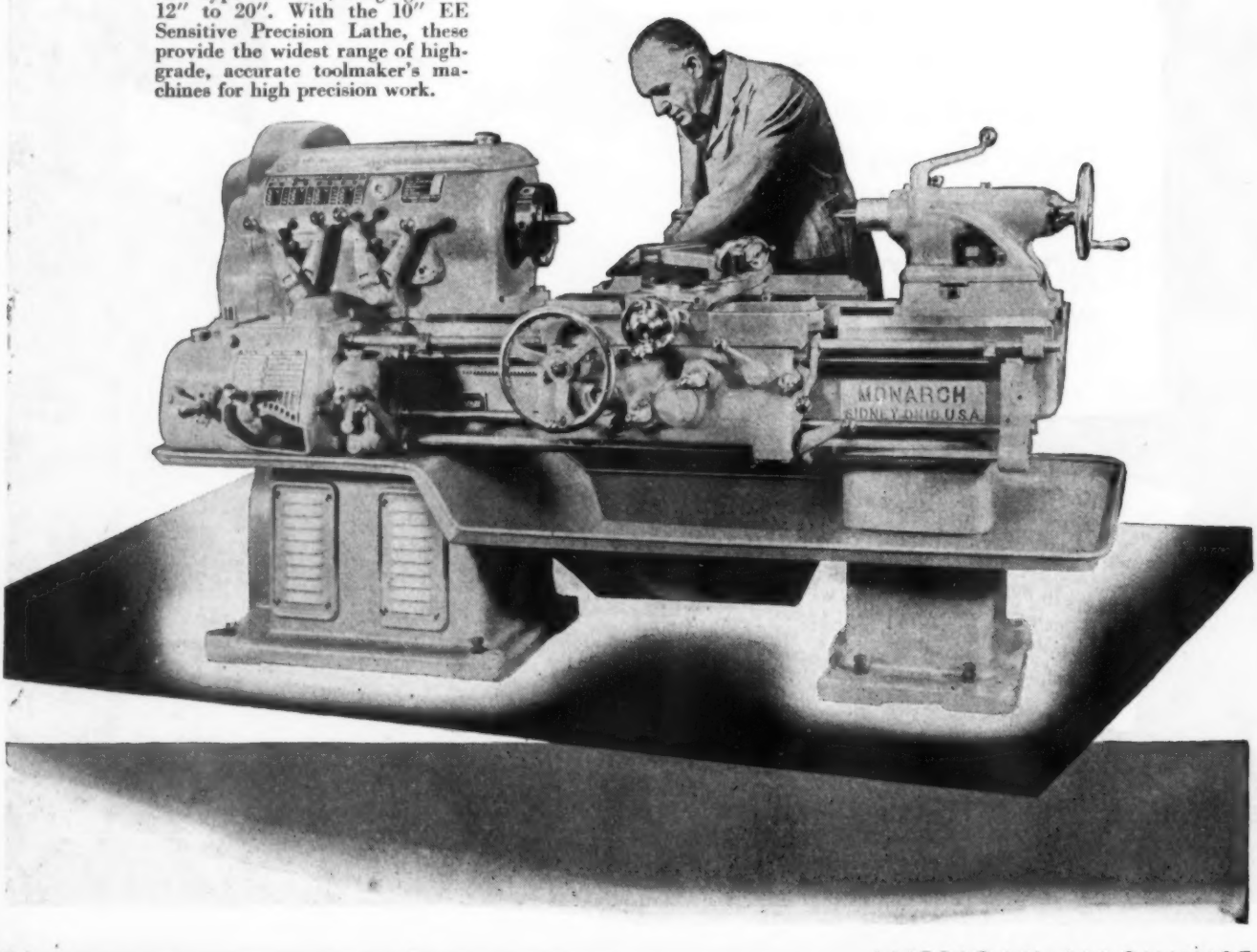
Flame-hardened bedways assure higher quality, more accurate production because of bearing surfaces that will not score, scratch or pit under proper use, and that will retain these qualities for many years.

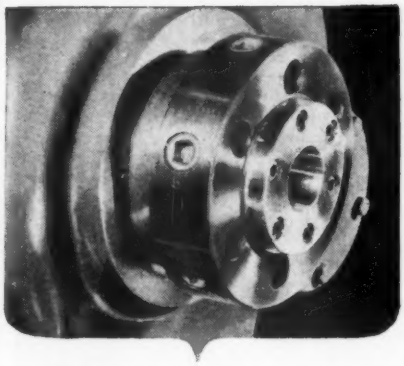


Taper attachment: high degree of accuracy and finish is obtained in turning extremely acute angles with the Monarch Anti-Friction Bearing Taper Attachment and Variator. Tool is guided by a metal template which may be larger or smaller than the work.

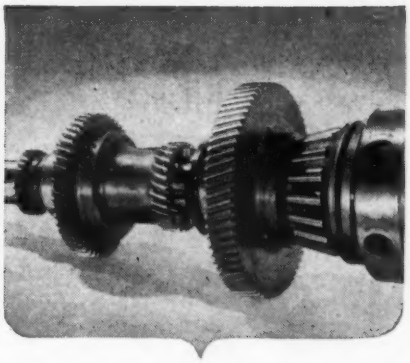
We'll argue this

Monarch Model C Toolmaker's Lathe: one of 5 sizes available in this type of lathe, ranging from 12″ to 20″. With the 10″ EE Sensitive Precision Lathe, these provide the widest range of high-grade, accurate toolmaker's machines for high precision work.

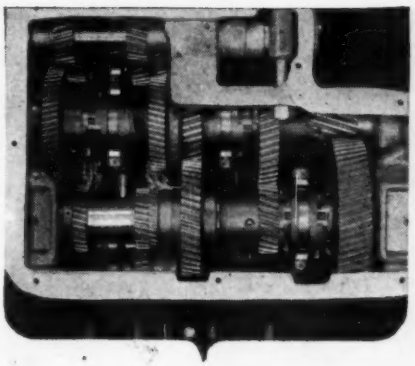




Camlock spindle nose: another cost reducer, because of time saved in attaching chucks and plates. Retains accuracy during life of the lathe, thus contributing to higher quality production.



Helical Gears: adopted by Monarch in 1924. By the elimination of gear tooth marks on finished parts, this Monarch development has added much to the quality of turning work and has permitted higher speed operation without noise and chatter.



Hardened and ground parts: all gears, spindles, shafts and other bearing surfaces in Monarch lathes are heat-treated and ground. Shafts in headstock are mounted on antifriction bearings. These mean smoother operation over the years, higher quality production and longer life.

with your Sales Manager

IT might be hard to convince your sales manager that modern production machines are really *sales tools*. But let's look at it this way, using Monarch turning machines as examples.

Monarchs can help you make a better product, because they turn finely finished parts as accurate as your blueprints. That means smoother assemblies, better operation of your product. Certainly, that's a sales advantage.

Besides improving quality, Monarchs *reduce costs* by permitting you to get more work per hour and per dollar of machine investment. That means lower prices. And certainly, a price advantage will please any sales manager.

Finally, because Monarchs are dependable and have amply demonstrated, in war production, their ability to stand up even under severe working conditions, you can maintain your *delivery schedules*. That's important, too.

So, for your peacetime production, consider Monarch turning machines as sales tools as well as factory tools. Remember, when you make more goods available to more people at less cost, you are giving your customers, the American workers, a chance to earn more, buy more, have more.

THE MONARCH MACHINE TOOL COMPANY • SIDNEY, OHIO

DIRECT FACTORY BRANCHES

CHICAGO 6, ILLINOIS
622 W. Washington Blvd.
Phone: Randolph 4295

CLEVELAND 6, OHIO
Room 209 Upper Carnegie Bldg.
10465 Carnegie Avenue
Phone: Garfield 2590

DETROIT 2, MICHIGAN
801 Fisher Building
Phone: Trinity 1-0426

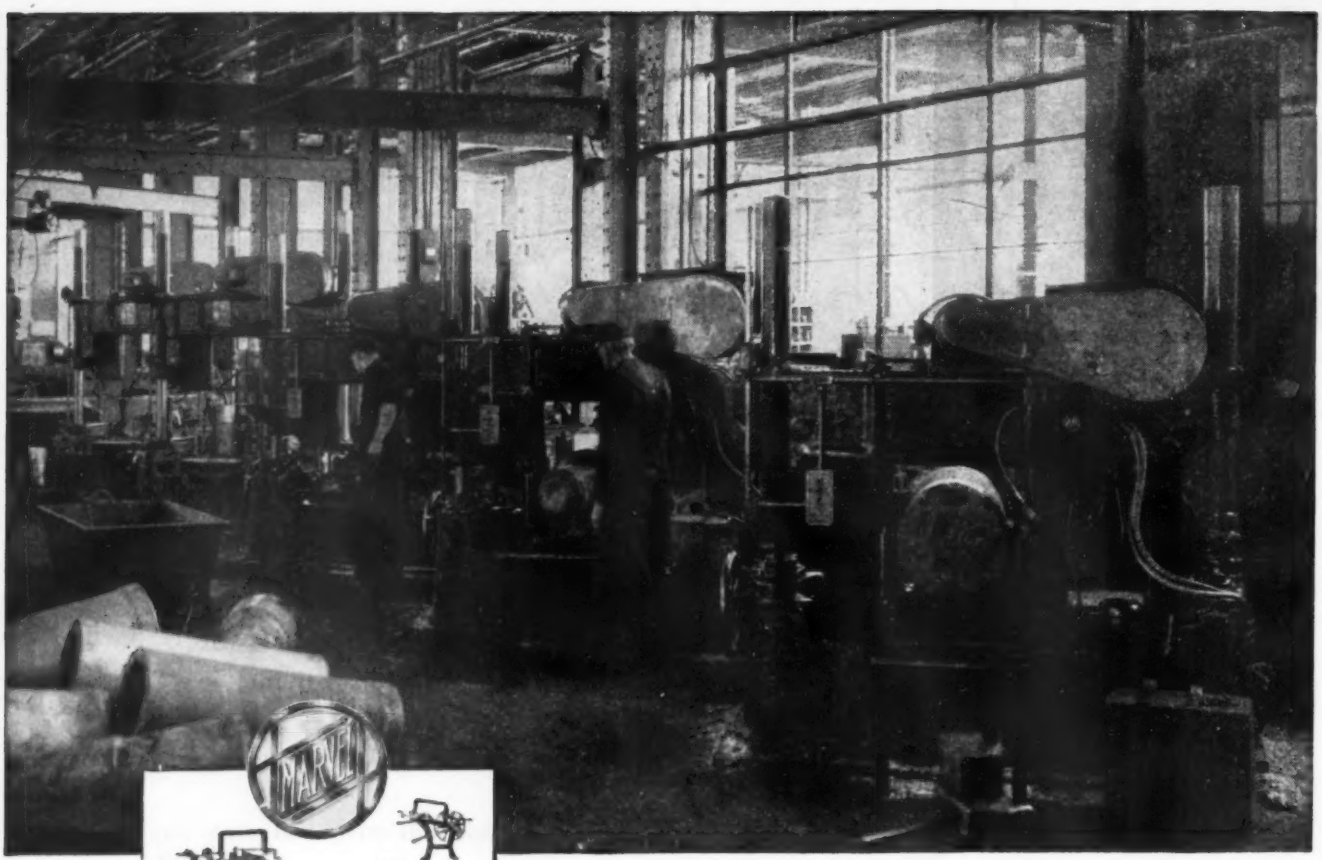
INDIANAPOLIS, INDIANA
Maco Building
38 and College Avenue
Phone: Wabash 2650

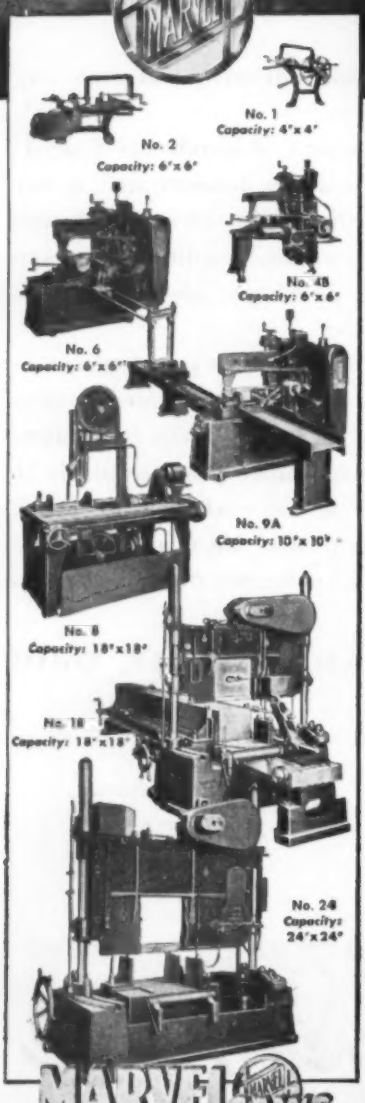
NEWARK 2, NEW JERSEY
635 Industrial Office Bldg.
Phone: Mitchell 2-1770

PITTSBURGH 22, PENNSYLVANIA
512 Empire Building
Liberty Ave. and Stanwix St.
Phone: Atlantic 6428

Representatives in Principal Cities

Monarch Saves Time





HACK SAW METHOD STEPS UP LOCOMOTIVE PRODUCTION

In the large shops of the American Locomotive Co., at Schenectady, wartime production has reached a new peak.

Among the improved methods contributing to this record output has been the increase in the use of the modern MARVEL Hack Saws for cutting-off even the largest work: for cutting-off car axles, wrist pins and all large forgings — work formerly done with more expensive methods and costlier equipment. One of the first to discover the efficiency and economy of the hack saw method for large work, this company ordered three No. 18 MARVEL Giant Hydraulic Hack Saws soon after these revolutionary Saws were first announced. Today, they are using twenty MARVEL Sawing machines, including eleven of these massive, ruggedly built, giant hydraulics.

MARVEL Saws are increasing the production of war materials in all parts of the country by rapidly, accurately and economically cutting-off the toughest steels in cross sections up to 24" x 24". If you have metal sawing problems, call on the local MARVEL Engineer to recommend methods and equipment.

ARMSTRONG-BLUM MFG. CO.

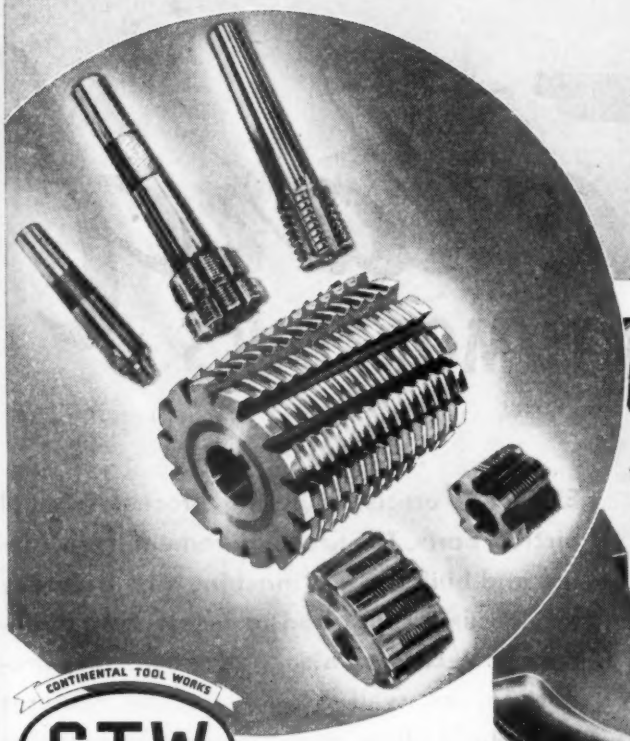
"The Hack Saw People"

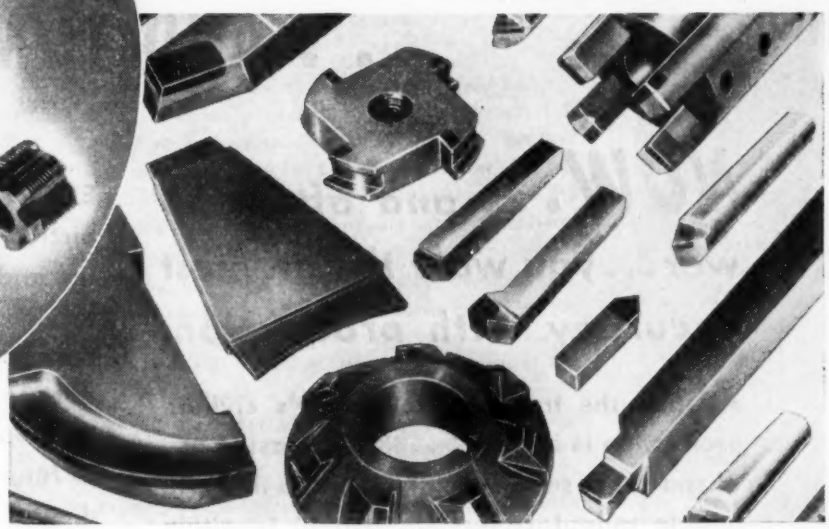
5700 W. BLOOMINGDALE AVE. CHICAGO 39, U.S.A.

Eastern Sales Office: 225 Lafayette St., New York 12, N. Y.

MARVEL SAWS

Check CONTINENTAL for Precision CUTTING TOOLS





CONTINENTAL TOOL WORKS
CTW
EX-CELL-O CORPORATION

Since 1919 The Continental Tool Works (a division of Ex-Cell-O Corporation) has been producing special and semi-standard cutting tools to customers' drawings or part prints—until today the Continental name in the cutting tool field is commonly used as another word for "accuracy and quality." This long experience, coupled with the most modern and complete facilities, makes Continental the first choice as a cutting tool source. *Find out now how Continental can help assure you of high production efficiency*—get in touch with your nearest Ex-Cell-O representative or write direct.

CONTINENTAL TOOL WORKS

DIVISION OF EX-CELL-O CORPORATION

DETROIT 6, MICHIGAN

45-22

EX-CELL-O *makes* Special Multiple Way-Type Precision Boring Machines • Special Multiple Precision Drilling Machines • Precision Thread Grinding, Boring and Lapping Machines Broaches and Broach Sharpening Machines • Hydraulic Power Units • Grinding Spindles • Drill Jig Bushings • Continental Cutting Tools • Tool Grinders • Fuel Injection Equipment • R. R. Pins and Bushings • Pure-Pak Paper Milk Bottle Machines • Aircraft and Miscellaneous Production Parts

TODAY'S *Standard* . . . AND TOMORROW'S

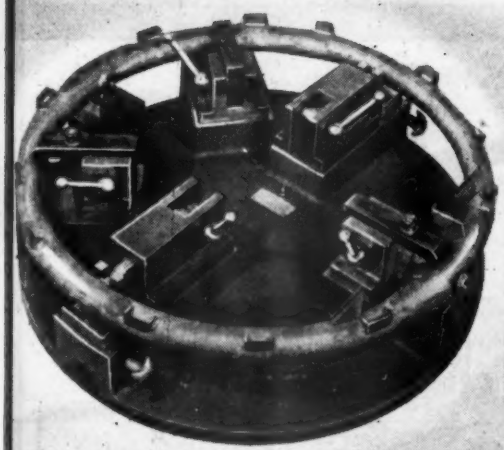
NOW . . . and after the war . . . you want the greatest accuracy with production.

Already the trend for tomorrow's civilian production is definite . . . the increasing use of special or semi-special machines that will enable manufacturers in general to attain the extreme accuracy the users of high precision machines are now obtaining in the aircraft and other war industries. Typical of these precision machines is the one illustrated here. It's a practical application of the Ex-Cell-O precision boring process to vital aircraft parts. The first requirement in designing and building this machine was accuracy . . . accuracy that had to be steadily maintained. Necessary also was satisfactory production, as well as construction features that would allow adaptation of the machine to future needs. This Ex-Cell-O machine indicates the flexibility, accuracy and simplicity in use demanded of *precision* machine tools in war . . . and for postwar planning.

EX-CELL-O CORPORATION
DETROIT 6, MICHIGAN

XLO
EX-CELL-O *for* PRECISION

SPECIAL MULTIPLE WAY-TYPE PRECISION BORING MACHINES • SPECIAL MULTIPLE PRECISION DRILLING MACHINES • PRECISION THREAD GRINDING, BORING AND LAPPING MACHINES • BROACHES AND BROACH SHARPENING MACHINES • HYDRAULIC POWER UNITS

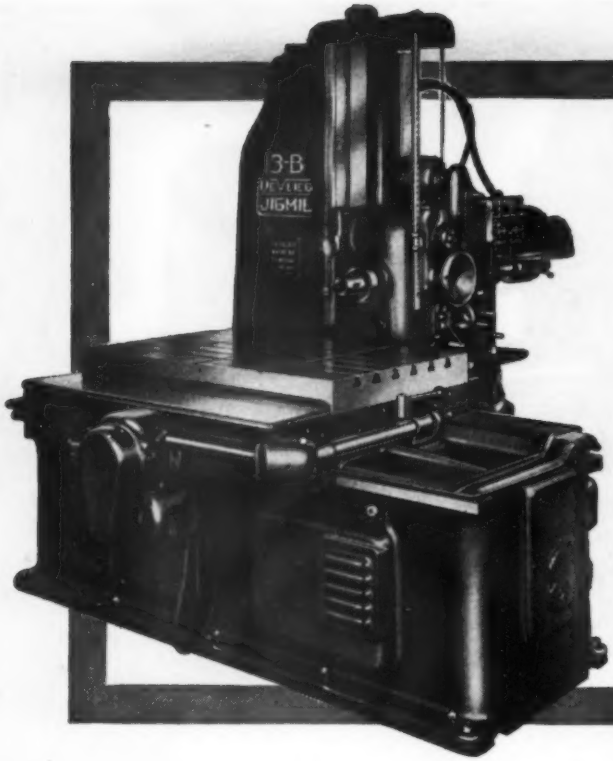


If you're interested in production with precision, and special machine tools with flexible construction and automatic features, send for this new catalog on Ex-Cell-O Way Machines. Ask for Bulletin 31631.

This Ex-Cell-O machine was designed to produce extremely accurate holes in aircraft tail turret rings and cradles at exactly 90° around the outside of the part, and do this on a satisfactory production basis. The machine is of the three-way type, utilizing standard precision boring end sections with a special cast center section to which the three units are attached. This arrangement insures accuracy and at the same time allows for the utilization of the end sections on postwar work. Two parts are machined; one a tail turret ring of steel *(in insert)*; the other, a tail turret cradle of magnesium *(on machine)*. An accurate hand-type index table is installed on the center section with interchangeable fixture plates to handle both parts. After the part is loaded, the operation button is depressed and three units simultaneously finish bore three of the four holes, after which the part is indexed 180° and the fourth hole is finish bored by the back spindle. The operational sequence is lined up so that this is done by merely pressing the starting button. Accurate indexing pins are plugged into the fixture at each index to assure complete accuracy. After a certain number of rings are bored, the cradle index plate is mounted. The cradle is both semi-finish and finish bored. It has just the two opposing holes, bored at the right and left units, after which it is indexed 90°, then 180°, with the back spindle doing the finish boring of both holes.

45-32

GRINDING SPINDLES • DRILL JIG BUSHINGS • CONTINENTAL CUTTING TOOLS • TOOL GRINDERS • FUEL INJECTION EQUIPMENT • R. R. PINS AND BUSHINGS • PURE-PAK PAPER MILK BOTTLE MACHINES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS

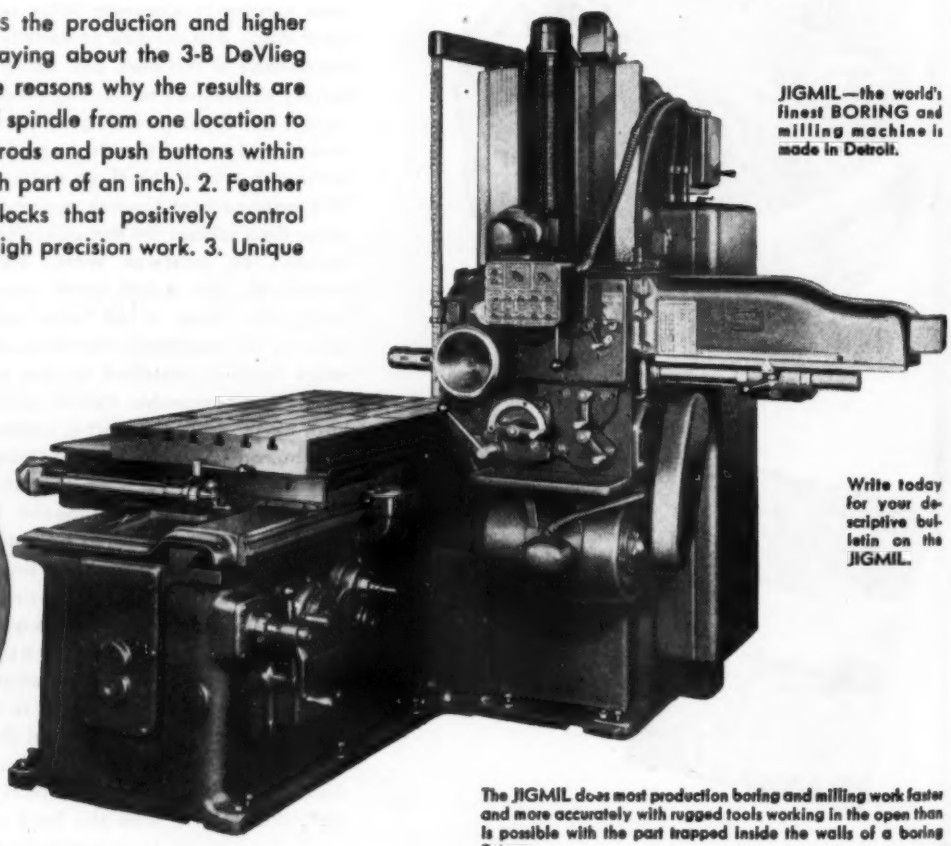


★

The JIGMIL has proven to be a totally new approach to the problems of economical precision BORING and milling . . .

★

"TWO TO THREE TIMES the production and higher quality work" is what users are saying about the 3-B DeVlieg JIGMIL—and here are some of the reasons why the results are better: 1. Automatic positioning of spindle from one location to another in response to measuring rods and push buttons within less than .0001 (one ten thousandth part of an inch). 2. Feather touch, pressure controlled slide locks that positively control locking uniformity, so essential to high precision work. 3. Unique operation and controls that make possible high precision work with relatively little skill.



JIGMIL—the world's finest BORING and milling machine is made in Detroit.

JIGMIL YOUR WORK

Write today for your descriptive bulletin on the JIGMIL.

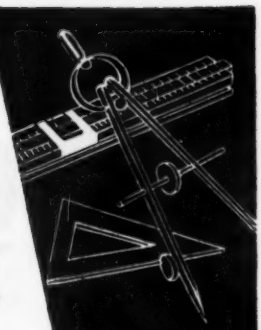
The JIGMIL does most production boring and milling work faster and more accurately with rugged tools working in the open than is possible with the part trapped inside the walls of a boring fixture.

DeVLIEG MACHINE COMPANY DEVLIEG JIGMIL **450 FAIR AVE. FERNDALE 20, (Detroit) MICH.**

PRESSUREMATIC

PRESSES ARE ENGINEERED FOR . . .

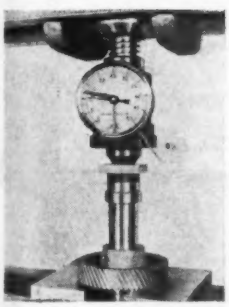
Power • Speed • Control



Select the ram travel, speed, and power you want. All are variable on the PRESSUREMATIC, the ideal press for assembling, press-fits, bending, straightening, die try-outs, and duplication of work pressures.

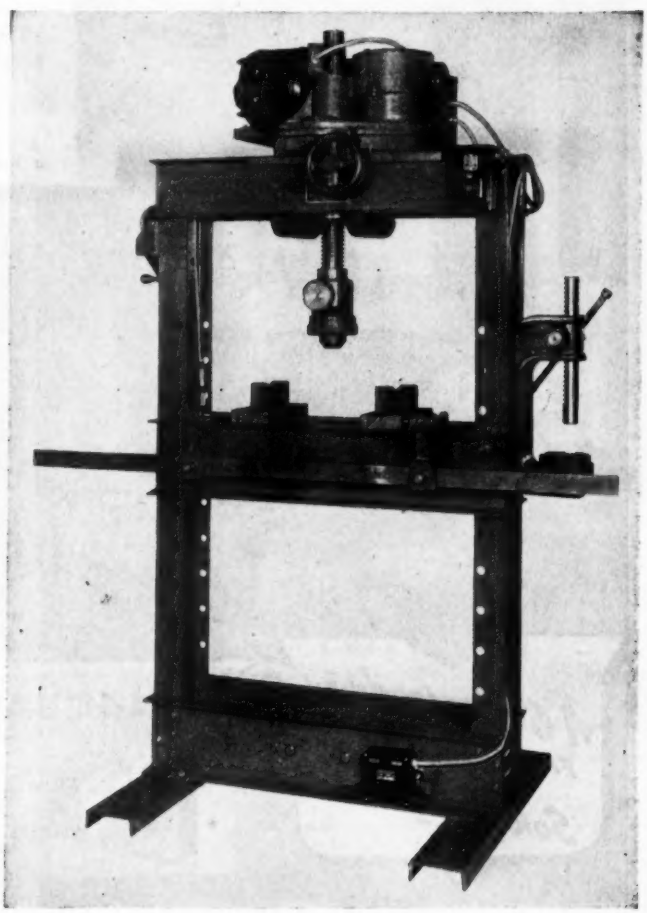
GOOD DELIVERY!

A FEW CONSTRUCTION FEATURES . . . foot pedal switches; adjustable bolster; movable ram head; reset type hand switch and thermal relays protect motor against overloads; can take work 54½" high; builds up from zero to 60 ton pressure in 4 seconds! Ram speed—3" to 12½" per minute; 9¼" standard Ram travel (14" travel available); maximum bolster travel 36"; maximum height between ram nose and floor bolster 54½"; 36¾" between columns. Sturdy, compact, powerful.



AUTOMATIC PRESSURE CONTROL

The pressure control system reverses the ram at any pressure at which the dial gauge has been previously set, and automatically continues the up and down stroke cycle of the ram until foot switch is released. Conventional manual control can stop automatic operation instantaneously at any time. Optional automatic pressure control holds spoilage to minimum, and enables even inexperienced operators to attain high production speeds.



★ *ELECTRIC & HYDRAULIC MODELS*

★ *20 to 60 TON CAPACITIES*

★ *GOOD DELIVERY*

★ *CEILING-PRICED*

WRITE FOR SPECIFICATIONS

LEMPCO

5711 DUNHAM ROAD
BEDFORD, OHIO, U. S. A.

Allis-Chalmers Electrodes Have Got To Be Good!

BECAUSE: 1) We use tons of them every day *ourselves*... 2) We constantly test weld metal by X-Ray, tensile machine, metallographic microscope — to assure continual high quality of electrodes.

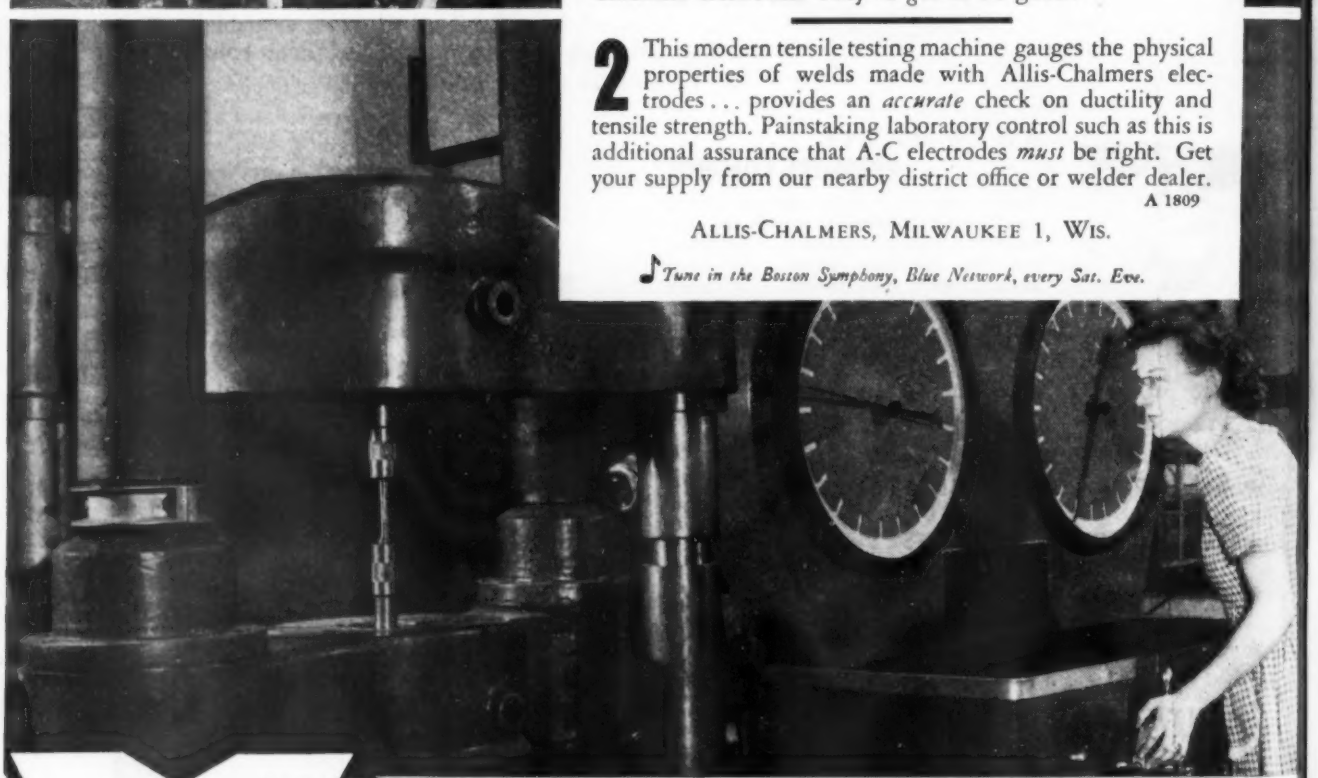
1 Being one of the world's largest *users* of welding equipment, we are able to *production-prove* our electrodes in our own Allis-Chalmers shops—under every type of welding condition. Large welding jobs such as this heavy compressor cylinder are everyday routine. Successful welding of this work *depends* on the quality of Allis-Chalmers electrodes. They've *got* to be good!

2 This modern tensile testing machine gauges the physical properties of welds made with Allis-Chalmers electrodes... provides an *accurate* check on ductility and tensile strength. Painstaking laboratory control such as this is additional assurance that A-C electrodes *must* be right. Get your supply from our nearby district office or welder dealer.

A 1809

ALLIS-CHALMERS, MILWAUKEE 1, WIS.

Tune in the Boston Symphony, Blue Network, every Sat. Eve.



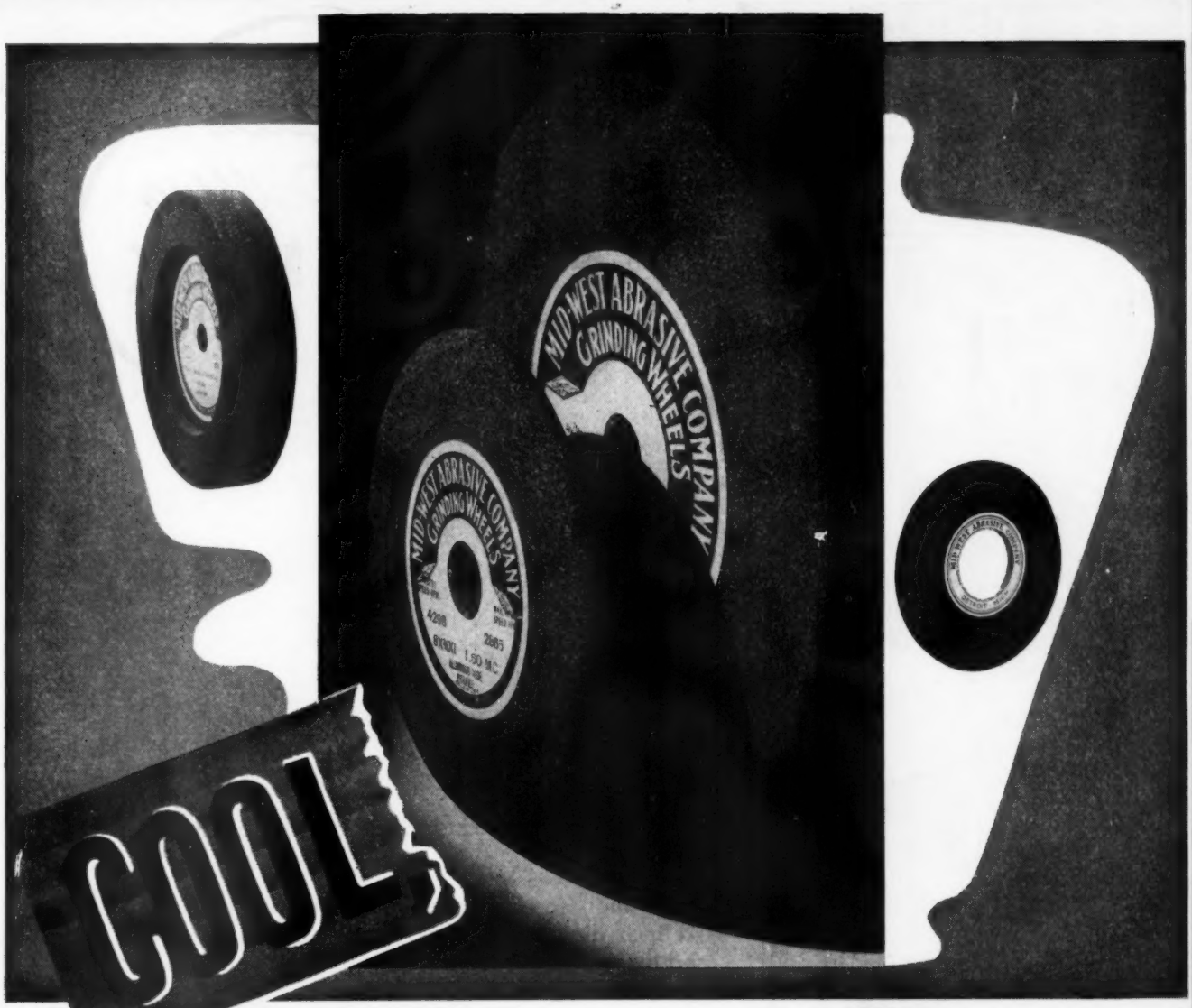
A-C Electrodes
EASY TO REMEMBER
EASY TO BUY
Sold by AWS Number

HEADQUARTERS FOR WELDING EQUIPMENT

AMPAC A-C WELDERS

WELD-O-TRON D-C WELDERS

ARC WELDING ACCESSORIES



Swift and Sure!

A grinding wheel that cuts cool at high rates of speed, producing amazingly fine tolerances, is only one of the many outstanding products of the Mid-West Abrasive Company.

Engineered quality is built into each of the many items in the broad Mid-West line of classifications—honing and sharpening stones, sandpapers, rubbing bricks, abrasive specialties or wheel dressers.

Let one of the Mid-West staff of experienced field engineers survey your abrasive needs and recommend the items to meet them.

MID-WEST ABRASIVE CO.

Manufacturers of DEPENDABLE Abrasives

Owosso, Mich. • 1960 E. Milwaukee, Detroit 11, Mich. • Rochester, Pa.

MAIL COUPON FOR

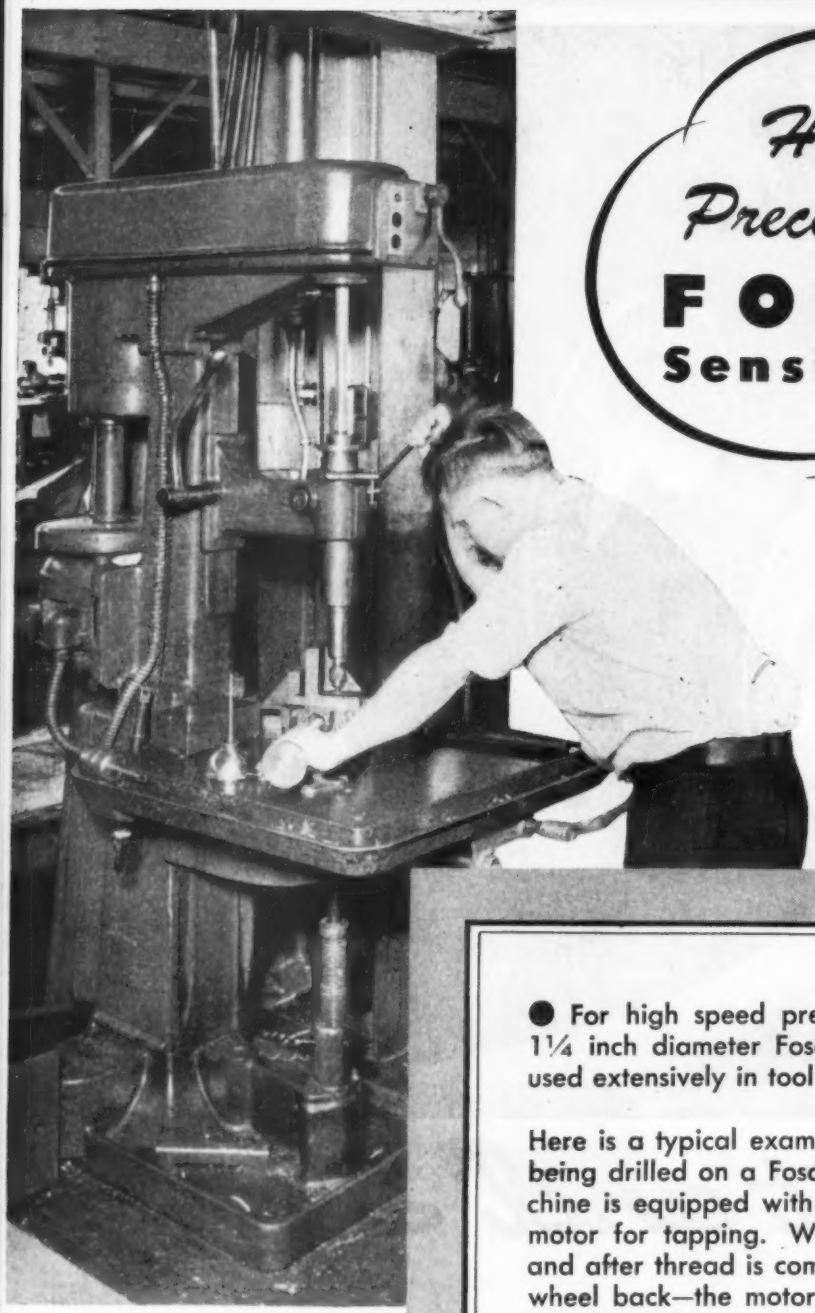
FREE POCKET HONE

Mid-West Abrasive Co.
1960 E. Milwaukee Ave., Detroit 11, Michigan

Please send me your complete data book on grinding wheels.

NAME_____

ADDRESS_____



High Speed Precision Drilling

FOSDICK
Sensitive Drills

● For high speed precision drilling of holes up to 1¼ inch diameter Fosdick Sensitive Drills are being used extensively in tool and die shops.

Here is a typical example of tool and die shop work being drilled on a Fosdick high speed drill. This machine is equipped with magnetic switch for reversing motor for tapping. With button in tapping position and after thread is completed you merely move hand wheel back—the motor will then run in the opposite direction backing out the tap.

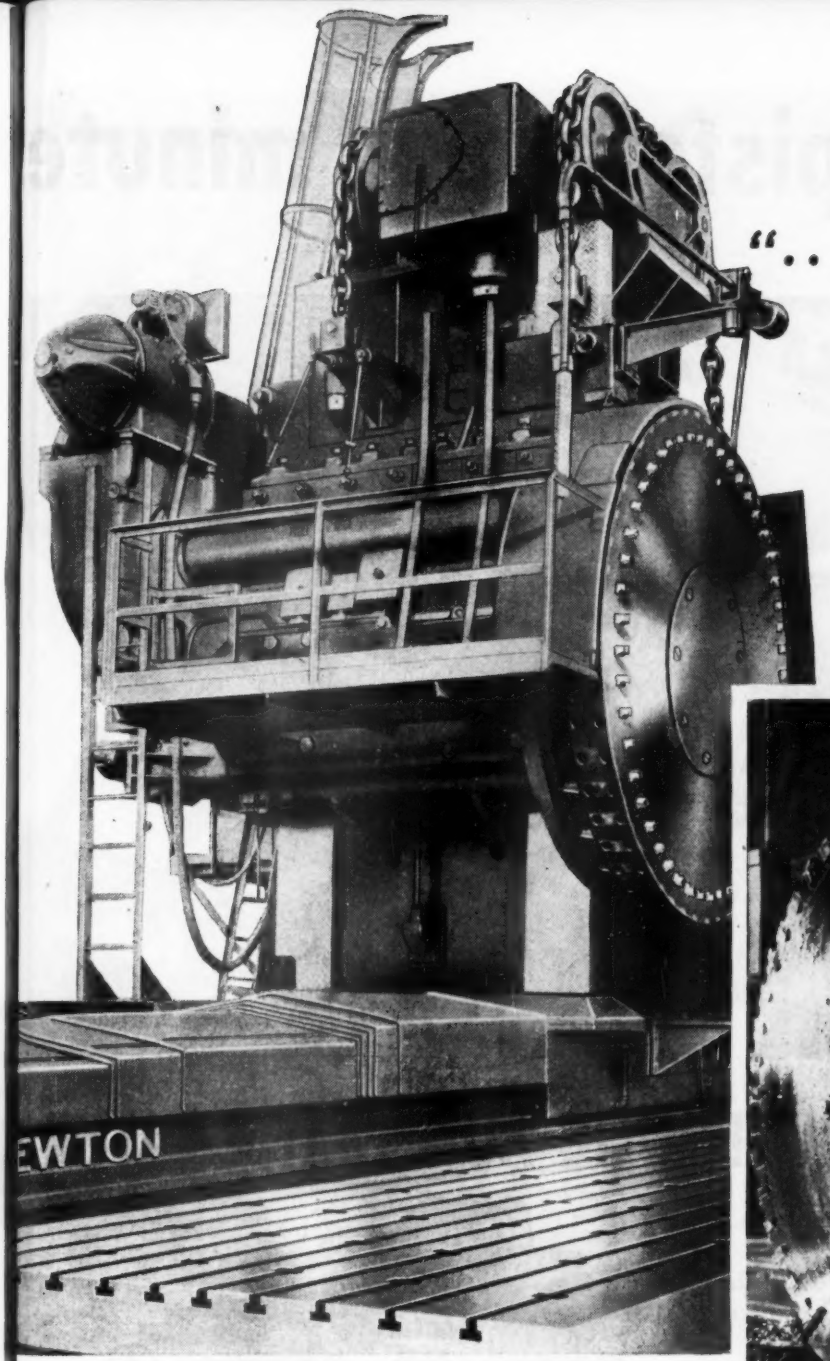
The simplicity of construction and operation—wide range of speeds from 110 to 1800 with standard single speed motors—and accuracy of this high speed drill make it most suitable for tool and die work.

For complete information write for High Speed Drill

Bulletin H.S.A.

ARMY (E) NAVY

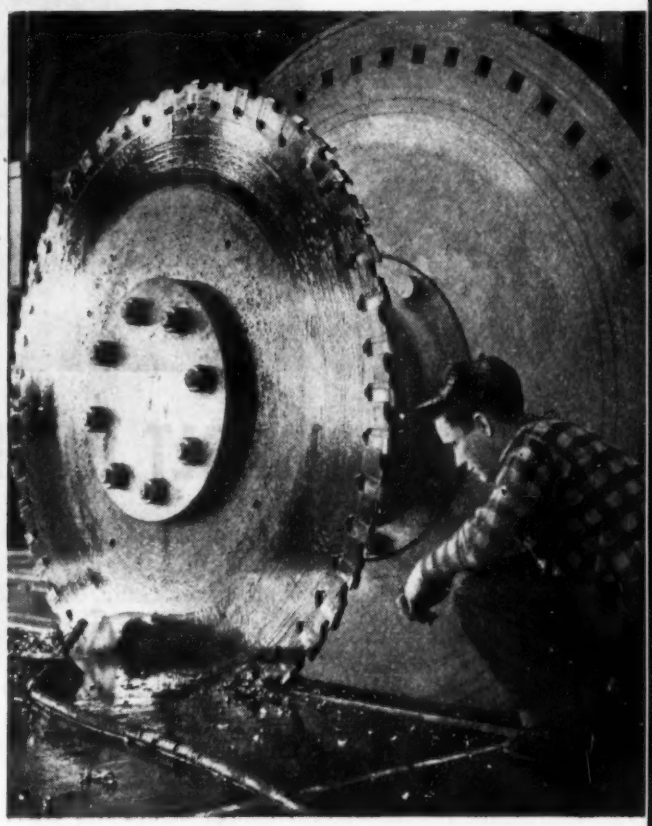
FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23, ··· OHIO



NEWTON COMBINATION COLD SAW AND 106" ROTARY PLANER

"... like a knife through cheese"

CUTTING HEAVY BATTLE-SHIP ARMOR PLATE



This Newton Combination Cold Saw and Rotary Planer, designed for cutting and machining tough steel plates, is but one of the many types of giant machines built by Consolidated. Other Newton Hydraulic Cold Saw Machines are built in a design range for handling all types of work in ferrous or non-ferrous metals. Built in sizes to accommodate blades from 32" to 120" diameter.

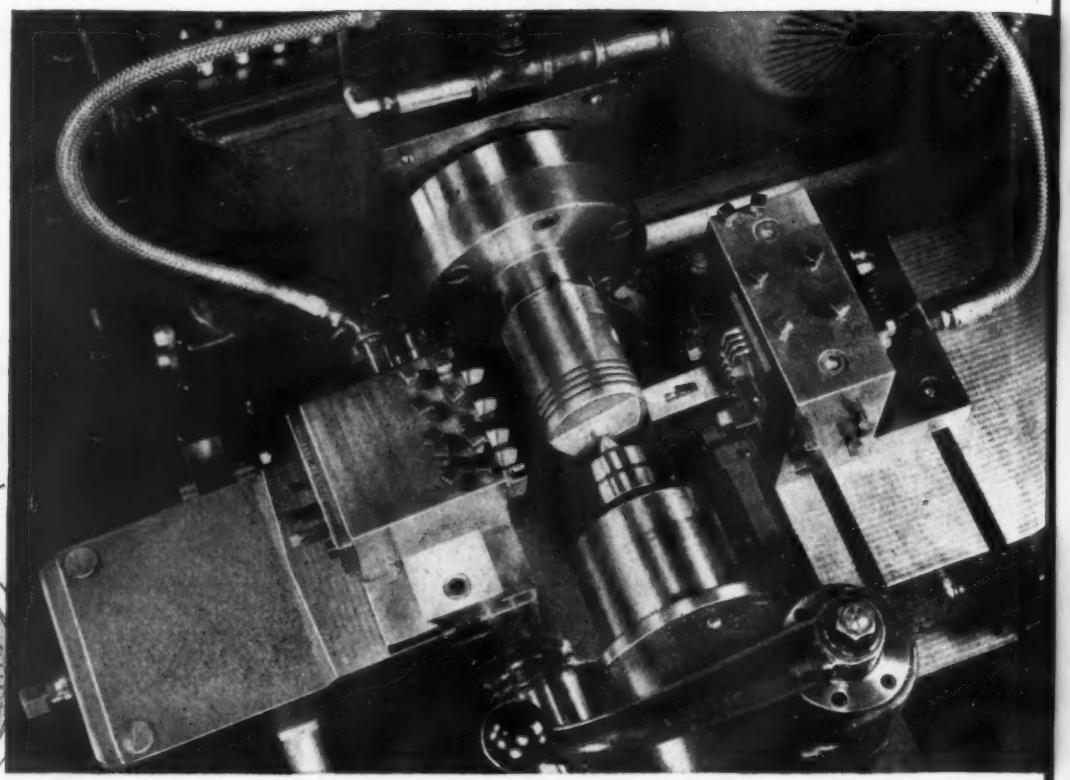
BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

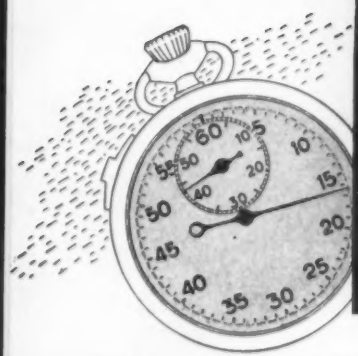
CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

3 pistons per minute!





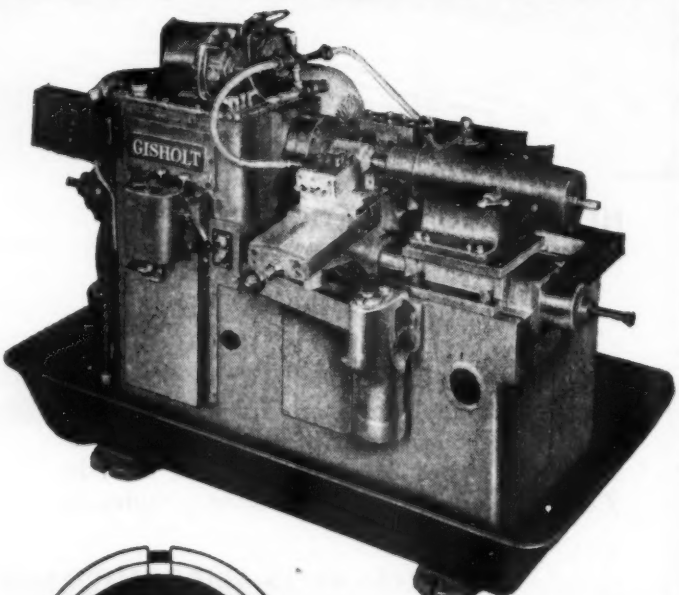
with the GISHOLT HYDRAULIC AUTOMATIC LATHE

This manufacturer, with aluminum pistons to turn out in large numbers, properly assigned the job to the Gisholt No. 12 Hydraulic Automatic Lathe. With the tool set-up shown here, the finish turning and grooving were done at a rate of 180 per hour, net.

Naturally, this calls for high spindle speeds; smooth, even feeds; quick approach and automatic return traverse of tools; easy operating tailstock, and an air-chucking fixture.

Those are the important things about the Gisholt Hydraulic Automatic Lathe. It's flexible, adaptable, fast . . . ready to handle a variety of between-centers or chucking work. And it's so easy to run that the operator has little to do but load the chuck, and remove the work when finished.

The Gisholt No. 12 means rock-bottom costs wherever the volume is sufficient to warrant automatic machining. Literature on request.



THE GISHOLT NO. 12 HYDRAULIC AUTOMATIC LATHE provides independent feeds for front carriage and rear slides, with an infinite selection of feeds from .000" to .055". Slides feed to positive stops, insuring utmost accuracy in finished dimensions. Elimination of feed gears, mechanical trips, cams, etc., greatly simplifies changes of setup.

GISHOLT MACHINE COMPANY
1201 East Washington Avenue • Madison 3, Wisconsin

Look Ahead . . . Keep Ahead . . . With
Gisholt Improvements in Metal Turning

GISHOLT

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

THE CONE AUTOMATIC MACHINE COMPANY
sees many
GOOD THINGS AHEAD

It is reported that . . . . . .

Helicopters capable of lifting as much as 15 tons and of carrying 35 or 40 persons, plus mail and baggage, are believed by one expert to be within the realm of possibility. *Col. H. F. Gregory, Engineering Division, Materiel Command, U.S.A.*

get ready with **CONE** for tomorrow

A pilot flying between South America and Africa recently flew across the Atlantic four times in three days. *Office of War Information.*

get ready with **CONE** for tomorrow

One of the country's leading department stores has scheduled a Postwar Fair for next May. Manufacturers are invited to participate, but space is not for sale. *R. H. Macy, New York City.*

get ready with **CONE** for tomorrow

Salvage apparatus for extremely great ocean depths has been patented. Its powerful jaws are guided by television apparatus. *Patent 2,355,086.*

get ready with **CONE** for tomorrow

Because of the high cost of converting ordinary electric power into high-frequency power, it is not at present believed that electronic cooking is practical for household use, although in commercial food processing it has great possibilities. Typical of its application to food processing is the recent experiment with packaged pancake flour in which the temperature inside the package was raised to 130 degrees in less than 30 seconds, completely destroying all insect life. *Scientific American.*

get ready with **CONE** for tomorrow

Rubber scientists think that they have solved the problem of ice on airplane propellors by the use of a three-ply rubber covering, the center layer of which is an electric heating element. *Goodyear Tire & Rubber Co.*

get ready with **CONE** for tomorrow

An inter-continental highway between Alaska and Siberia, by way of a tunnel under Bering Strait, is being seriously considered. *Alaska Highway Committee of Pacific Northwest Trade Association.*

Experiments are being made with plastic bottles blown in the same molds used for glass. *Advertising & Selling.*

get ready with **CONE** for tomorrow

A total of 29 dams is planned for the Pacific Northwest, the first six of which will cost 226 million dollars and provide power and water for a population of 2 million. *Engineering & Mining Journal.*

get ready with **CONE** for tomorrow

A new method of dyeing acetate rayon is said to make the colors practically fade-proof. *North Carolina Fabrics Corporation.*

get ready with **CONE** for tomorrow

A large airplane manufacturer has produced an experimental model of a 200 pound automobile. *Science Digest.*

The first commercial model of a sound-on-tape machine has been made and is said to play continuously for eight hours. *Fonda Corporation.*

get ready with **CONE** for tomorrow

The use of music in factories is expected to create jobs for 26,000 musically trained broadcast directors. *Science News Letter.*

get ready with **CONE** for tomorrow

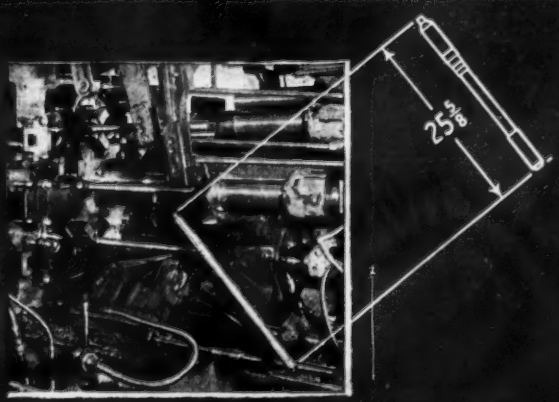
A new device that opens and closes a window thermostatically is waiting for release of materials to go into production. *E. O. Gillen, 1713 N. Water St., Milwaukee.*

get ready with **CONE** for tomorrow

A new eight-engined flying freight boat with 320 foot wing span is expected to be ready about the first of the year. *Howard Hughes, Aviation News.*

get ready with **CONE** for tomorrow

A new ingredient added to the Army's soap is said to make it work effectively in any sort of water, salt, fresh, cold, hot, soft, or hard. *E. I. duPont de Nemours & Co. Inc.*

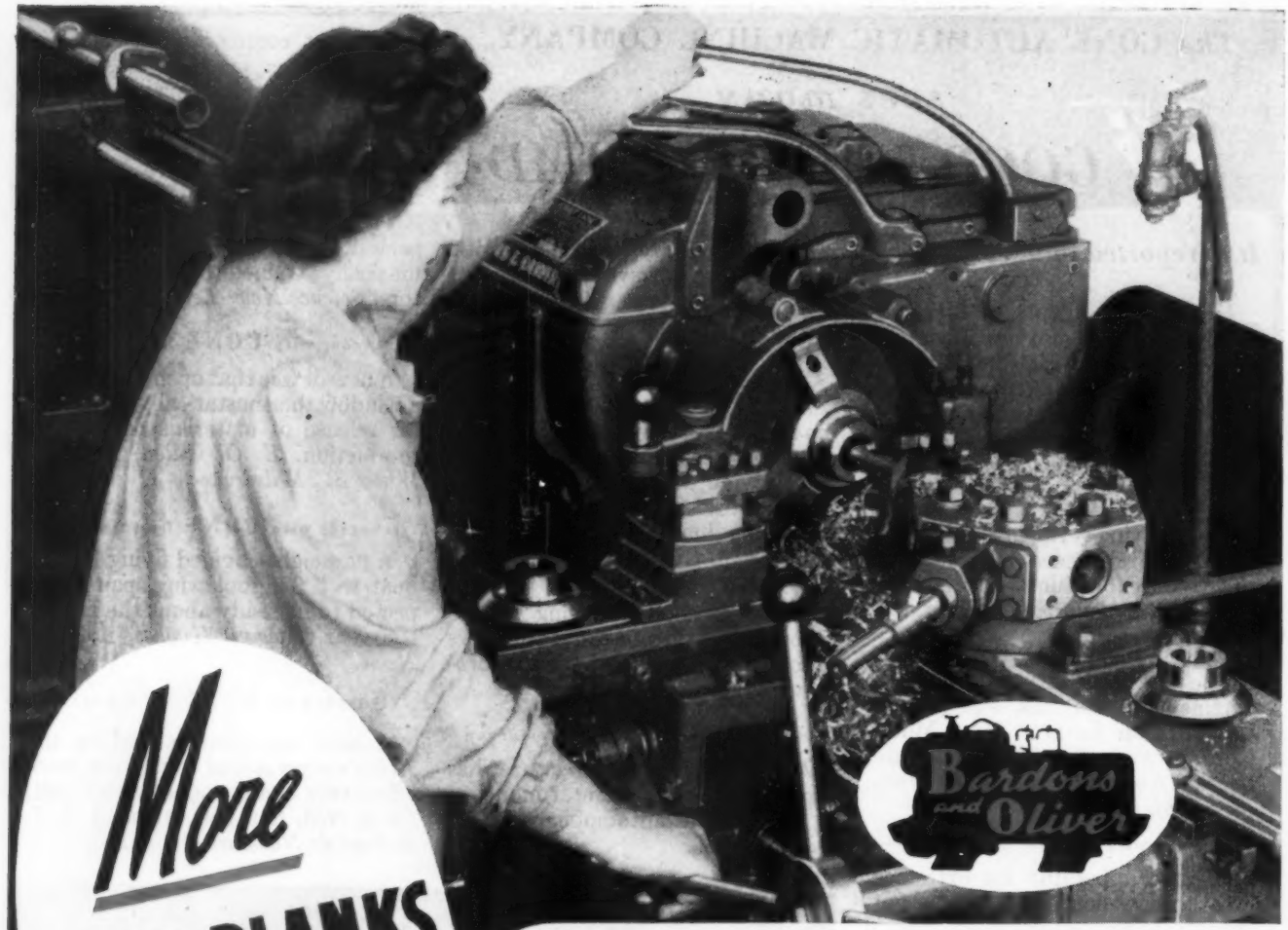


...and remarkable things are being done NOW

Turning a shaft of this length was considered impractical for a multiple spindle automatic screw machine — until it was produced on an [illegible] Cone. Its unusually fast time of 63 sec. was [illegible] plus high precision, has given us the best equipped [illegible] in the world and will, when the war is won, make our manufacturers the most productive in the world.

CONE

AUTOMATIC MACHINE CO. INC. BELLOWS FALLS, VERMONT, U. S. A.

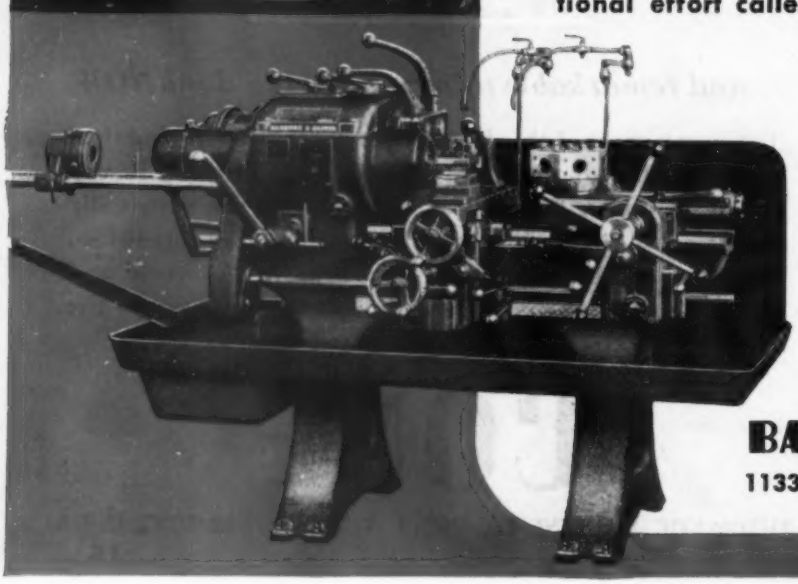


More GEAR BLANKS per day—

because

THE HYDRAULIC SPINDLE BRAKE STOPS THE CHUCK INSTANTLY. No extra effort is required by the operator. By moving the control lever from driving to neutral position, a powerful yet elastic multiple disc brake is applied. No loss of time, no additional effort called for. The chuck is ready for unloading and re-loading.

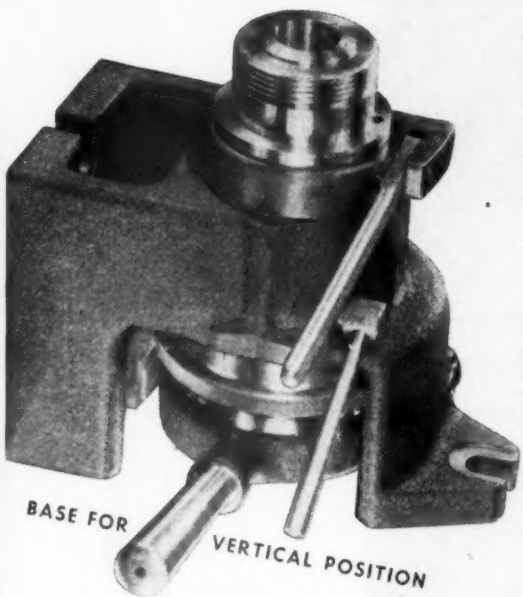
This is only one of several new features recently incorporated in The Bardons & Oliver No. 3 Universal Turret Lathe.



BARDONS & OLIVER, INC.
1133 WEST 9TH STREET CLEVELAND 13, OHIO

HARDINGE HORIZONTAL-VERTICAL

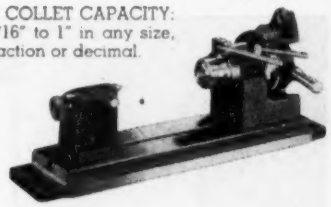
Collet Index Fixtures with Threaded Nose Spindle are fast in operation and hold work accurately



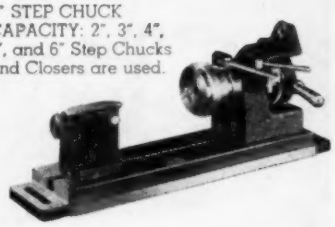
In addition to taking standard collets, this fixture takes step chucks and jaw chucks to cover a wide range of applications. It will eliminate the necessity of your tool room making many specially designed fixtures. Thus, your engineers and tool-makers will have more time for other work.

A preselector arrangement provides the selection of separate indexing of any number divisible into 20 or 24. The collet closer lever has a 100 to 1 leverage for quick opening and closing of collets and step chucks. Write for bulletin.

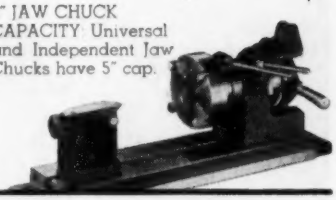
1" COLLET CAPACITY: 1/16" to 1" in any size, fraction or decimal.



6" STEP CHUCK CAPACITY: 2", 3", 4", 5", and 6" Step Chucks and Closers are used.



5" JAW CHUCK CAPACITY: Universal and Independent Jaw Chucks have 5" cap.



HARDINGE
ELMIRA, N.Y.

HARDINGE-SJOGREN SPEED COLLET CHUCKS

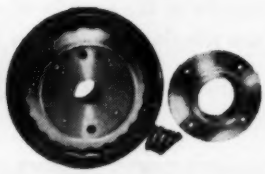
increase production of your lathes and milling machines

A Hardinge-Sjogren Nose Type Speed Collet Chuck enables you to get full value from your toolroom lathes, engine lathes and milling machines. It gives greater capacity, saves time, increases accuracy and assures better results. An almost effortless turn of the handwheel, one way or the other, automatically opens or closes the collet, releasing or gripping the work as desired. Its grip is adjustable and sure. Production is increased as the operator is always in front of his work. Available in three sizes for 1", 1 3/8", or 1 3/4" collet capacity. Write for complete bulletin.

For CAM-LOCK SPINDLES

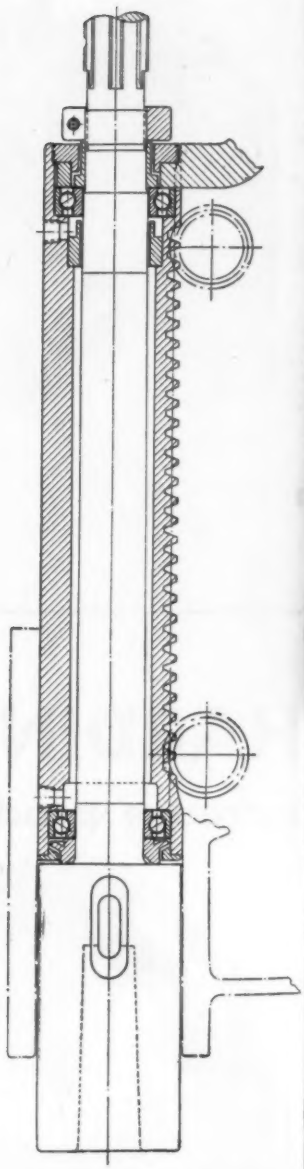
For TAPERED KEY-DRIVE SPINDLES

For THREADED NOSE SPINDLES



"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

RIGIDLY SUPPORTED CLOSE TO THE CUTTING TOOL



● Built by THE CINCINNATI BICKFORD TOOL CO.

Operating at speeds up to and above 3500 r.p.m., the spindle on this 9" column High-Speed, All-Geared Super Service Radial does not feed away from its bearings. It's always rigidly supported by SKF Ball Bearings close to the cutting tool, no matter how far the spindle is extended. These SKF's take both radial and thrust loads . . . maintain long-lived accuracy . . . are packed in grease and well protected against the ingress of foreign matter. Once adjusted in assembly by means of a nut at the upper end of the spindle, they eliminate end play. Another good example of the way in which machine tool manufacturers everywhere are winning the war on Friction. 5750

SKF INDUSTRIES, INC., PHILADELPHIA 34, PENNA.

SKF BALL BEARINGS

PRODUCTION STAYS HIGH

When Good Cutters are on the Job

. . . only **Good Cutters**, with such features as these, deliver a maximum number of cuts between sharpenings at a high rate of production . . . insuring a constant high output.

1 CORRECT RAKE & CLEARANCE ANGLES

2 AMPLE CHIP SPACE

3 TOUGHNESS — DEVELOPED BY SCIENTIFIC HEAT TREATMENT

4 MODERN DESIGNS

Brown & Sharpe Cutters give you all of these advantages.

. . . We urge buying through the Distributor

Catalog No. 34 listing complete line sent on request. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

B·S

BROWN & SHARPE CUTTERS

COLLETS *with Character*

A RIVETT DRAW-IN COLLET has personality derived from a worthy inheritance and a steadily improved environment. Today when a RIVETT COLLET is shipped in its distinctive carton it reflects fifty years of experience and the most advanced methods in manufacture and inspection.

RIVETT DRAW-IN COLLETS are available in all standard styles for bench lathe, engine lathe, miller and grinder use. Work held in a RIVETT COLLET is guaranteed to run "dead true" at the collet mouth and within .002" two inches from the collet mouth. For complete information on all RIVETT COLLETS and their adaptation to existing machines write for Bulletin 100.

CARRIED FOR STOCK DELIVERY

By Machinery Sales Company

3838 Santa Fe Ave.
Los Angeles, Calif.

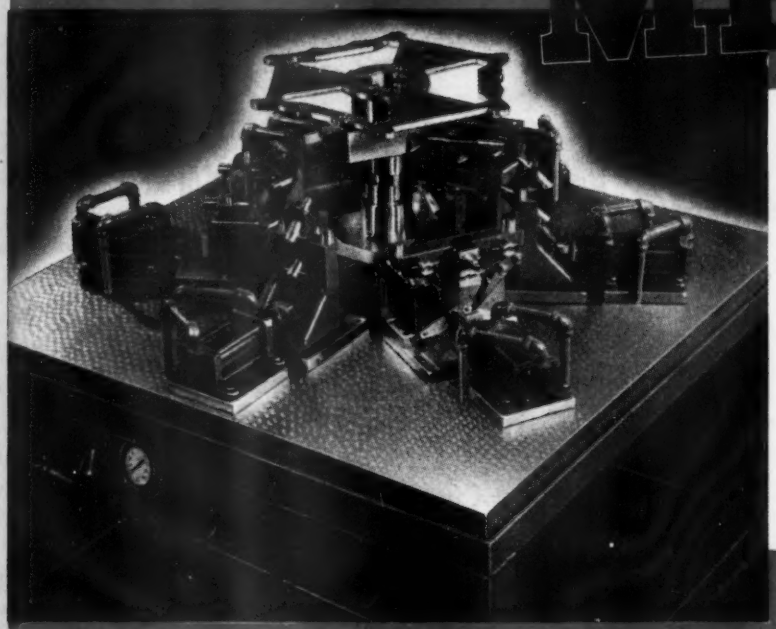
1274 Folsom St.
San Francisco, Calif.

RIVETT

RIVETT LATHE & GRINDER, Inc.

BRIGHTON • BOSTON • MASS. • U. S. A.

Everybody knows METRO



METRO CARBIDE TIPPED TOOLS AND METRO GAGES

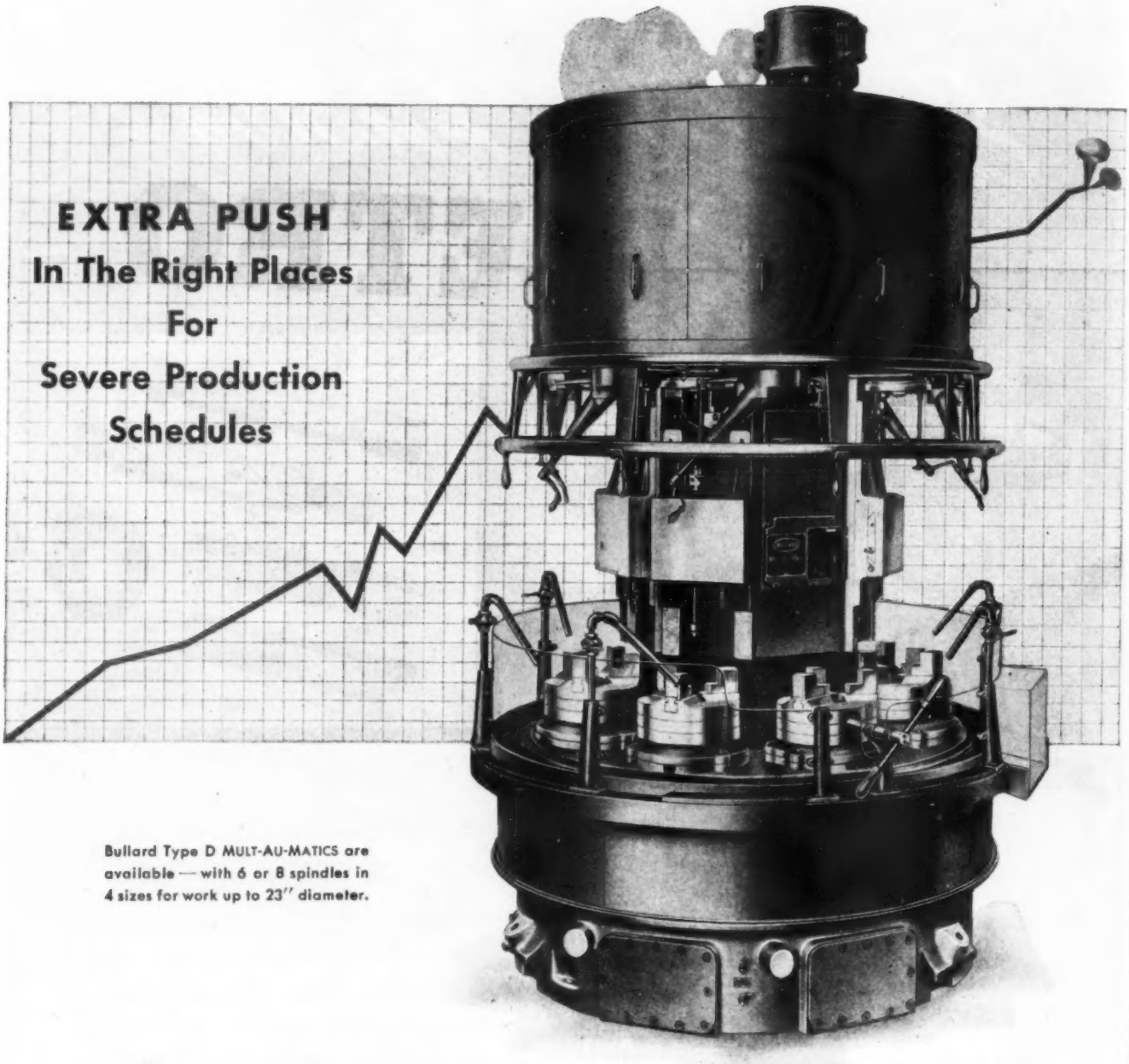
are well-known to American industry, either through use or reputation. Proved through peacetime production . . . doubly proved by the higher tempo and greater requirements of wartime production, Metro Gages and Carbide Tipped Tools are in a position to be doubly approved both by the men on the production line and by the dealers who supply them in the postwar years. Ask us, too, about special tools and gages for special jobs. Metro engineers will design them for you or make them up from your specifications.

Metro Standard Gages and Carbide Tipped Tools are available through your Metro distributor. Send for free catalog.

METRO TOOL AND GAGE CO.

4240 Peterson Avenue
Chicago 30, Illinois

EXTRA PUSH
In The Right Places For Severe Production Schedules



Bullard Type D MULT-AU-MATICS are available — with 6 or 8 spindles in 4 sizes for work up to 23" diameter.

Built to stand strains of high-speed, heavy-feed, tough-metal, long-run operations

Long life and maintained accuracy in multiple spindle mass production of all classes of castings, forgings and cut-off bar stock are assured by the extreme massiveness and rigidity built into the Bullard Type D MULT-AU-MATIC.

From the rugged base and sturdy carrier that guards alignment accuracy, up through the rigid column to the feed works that assure complete coordination of spindles, tool-carrying heads and indexing . . . this unified heavy construction is accurately controlled to meet every demand for efficient operation.

For complete details about the way the Bullard Type D MULT-AU-MATIC produces one finished piece (or two) within a few seconds of the time of the longest single boring, turning, facing, grooving or drilling operation, write today for Bulletin MAM-D. The Bullard Company, Bridgeport 2, Connecticut.

BULLARD

CREATES *NEW METHODS* TO MAKE MACHINES DO MORE

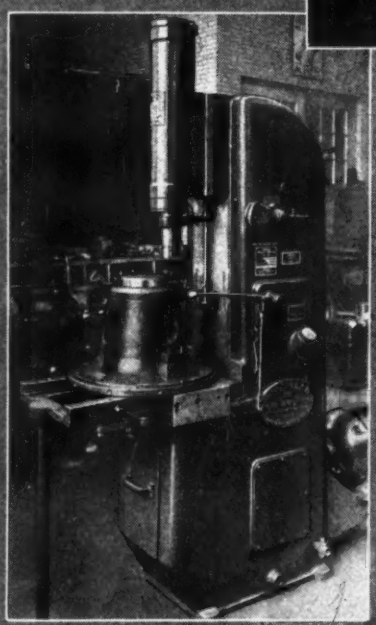
Put this

"JACK-OF-ALL-TRADES" on your production line!

Standard American Hydraulic Press does many types of jobs!

A standard machine capable of performing a variety of different operations is the V-1-½ 4-ton *American* Hydraulic Press. It can handle innumerable tooling adaptations for use on a wide variety of parts. Reconversion is no problem with versatile equipment of this kind.

Let *American* engineers show you how standard *American* equipment can serve you in war production today, yet be easily converted to perform your peacetime manufacturing operations. There is no obligation. Write today for further details.



The flexibility of the standard V-1-½ machine is graphically illustrated in the accompanying photographs. The upper picture shows the set-up for broaching a dovetail slot in rifle sights. High rate of production is maintained with ease of handling. The illustration at left shows the same machine tooled for assembling studs in an aircraft gear housing. This set-up features automatic indexing and locating of the part for pressing home the studs.

Protect your broaching tools when not in use. Tools last longer and give more satisfactory service if this precaution is taken.

MEMBER BROACHING TOOL INSTITUTE

American BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

DIVISION OF SUNDSTRAND MACHINE TOOL CO.

No "softies", these "Unbrako" Self-Locking Hollow Set Screws! Made tough at the start, they're hardened to "stand the gaff" and possess almost unbelievable strength, as proved by actual physical tests. What's more, they defy the menace of vibration and will not work loose of their own accord. When tightened as usual, the knurls *dig in and lock automatically.* Yet they can be readily removed with a wrench and used over and over again any number of times. Available in all sizes from No. 4 to 1½" diameter. Remember the name —be sure to specify "Unbrako" on your next order.

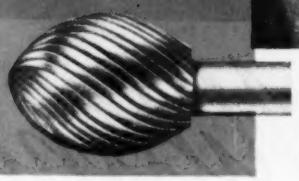
Knurling of Socket Screws originated with "Unbrako" years ago.

OVER 40 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 4 • BRANCHES: BOSTON • DETROIT • INDIANAPOLIS • CHICAGO • ST. LOUIS • SAN FRANCISCO

"CLEAN EARS" in a jiffy



Flame Shape Ground Rotary File used in clearing fillets of cast pump impeller.

ROTARY filing solves many production problems in getting at places otherwise difficult to reach. Die sinking, metal pattern making, tool making, mold finishing, and the finishing of small and intricate parts frequently present such problems.

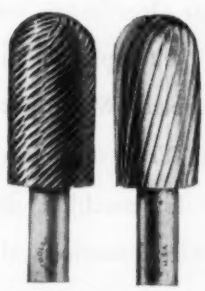
In such work, rotary files are extensively used for breaking and chamfering corners, removing burs and fins, cleaning, enlarging and elongating holes and slots; also for removing scale from aluminum, brass, bronze and iron castings.

It is fitting that Nicholson's vast experience in file making should become of service to industry in connection with rotary as well as other types of files. You may be sure that Nicholson Rotary Files will always be of the highest quality standard and that the Nicholson recommendations will be earnest and unbiased.

WRITE FOR CATALOG AND PRICE LIST

—and for any special information you desire. For deliveries, consult your mill-supply house.

NICHOLSON SELLS BOTH HAND CUT AND GROUND *types of Rotary Files—each in* **16** *standard styles or shapes; in* **3** *cuts (Coarse, Medium and Fine); in diameters of* 1/8" *to* **2**".



HAND CUT GROUND

NICHOLSON FILE CO. • 97 ACORN STREET, PROVIDENCE 1, R. I.

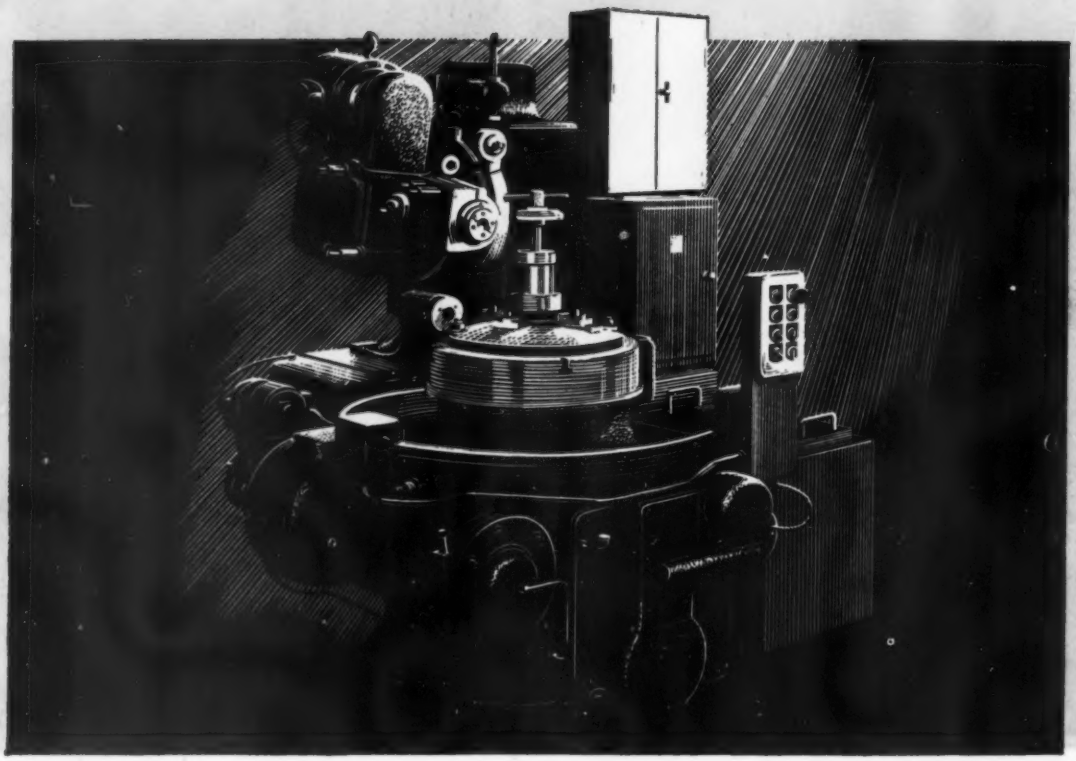
(In Canada, Port Hope, Ont.)

NICHOLSON ROTARY FILES

HAND CUT and GROUND

FOR EVERY PURPOSE

NICHOLSON U.S.A.



Milling THE SHAPE OF THINGS TO COME

Many of the new products of the future will be different—very different—yet when stripped down to fundamental design elements, there'll still be the same flat and curved surfaces to machine. Machining *methods* already are undergoing radical changes. A typical example is the adaptation of a recently-announced Westinghouse electronic device, the Mot-O-Trol, to a universal milling machine.

On this machine, the contour of the work-piece is obtained mechanically—but with the Mot-O-Trol, the feed rate is kept at a uniform number of feet per minute, automatically, regardless of irregularity of contour.

This electronic control equipment, equally adaptable to other types of machine tools, is only one of many new Westinghouse developments in machinery electrification. For years, machine tool builders have relied on Westinghouse for simple electrical solutions to complex mechanical problems. When you need this kind of help, call your nearest Westinghouse representative. Westinghouse Electric & Manufacturing Company, Box 868, Pittsburgh 30, Penna.

J-94653

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

THE MACHINE IN MACHINE TOOLS

What will make a gage *last longer?*

NORBIDE

NORBIDE Gages outwear conventional types of measuring devices 100 times and more. Made of Norton Boron Carbide — "the hardest material made by man" — NORBIDE Gages show exceptional resistance to abrasion and scratching, will not pick up lint or become charged with particles of metal, are inert to chemicals employed where gages are used. Because NORBIDE molded shapes are homogeneous the gage surfaces become even smoother with use. Ask your regular gage supplier about NORBIDE, or for further information write for booklet #1100-AM to:

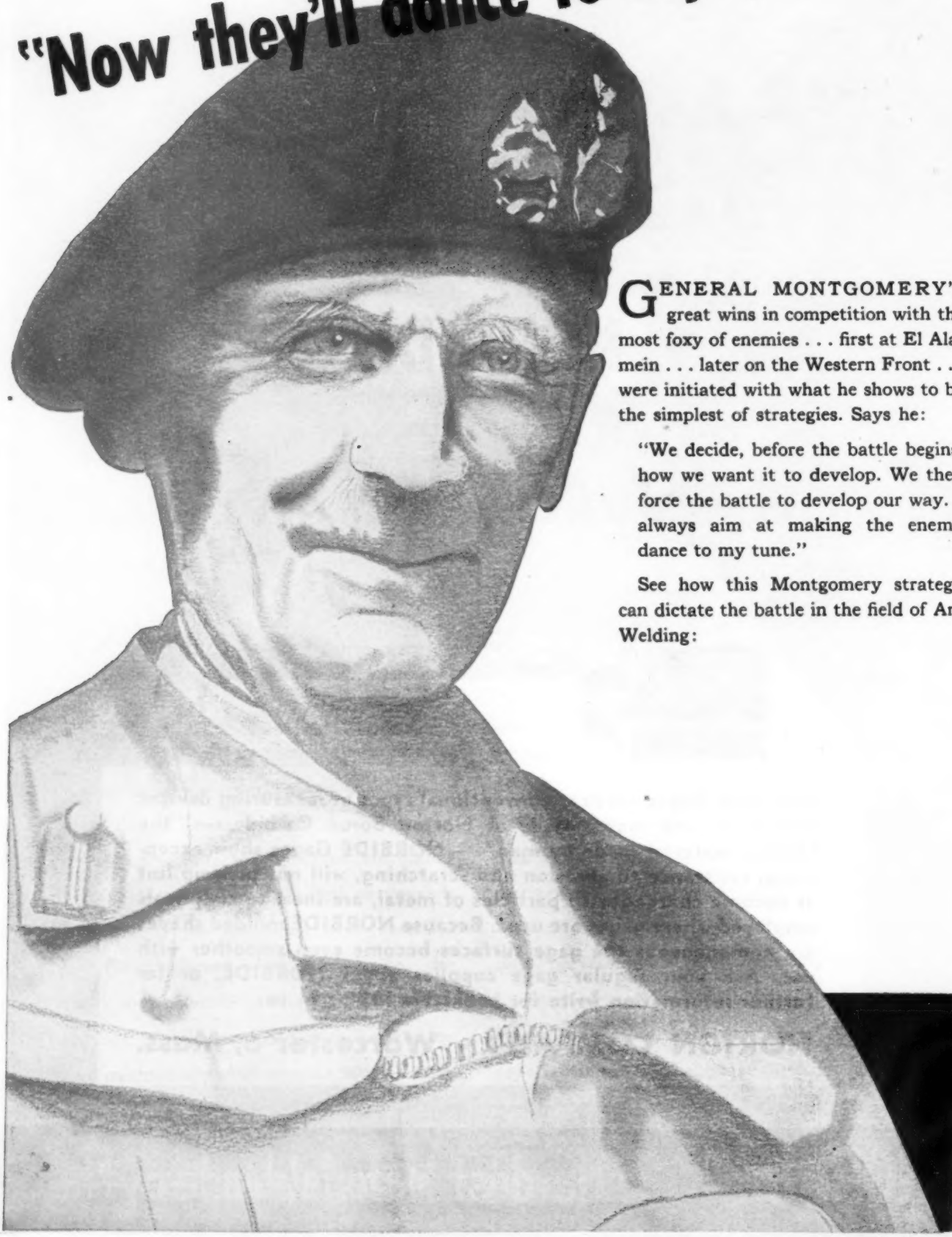
NORTON COMPANY - Worcester 6, Mass.

NORBIDE – The Hardest Material Made by Man

REGISTERED TRADE MARK

then he said to himself

"Now they'll dance to my tune"



GENERAL MONTGOMERY'S great wins in competition with the most foxy of enemies . . . first at El Alamein . . . later on the Western Front . . . were initiated with what he shows to be the simplest of strategies. Says he:

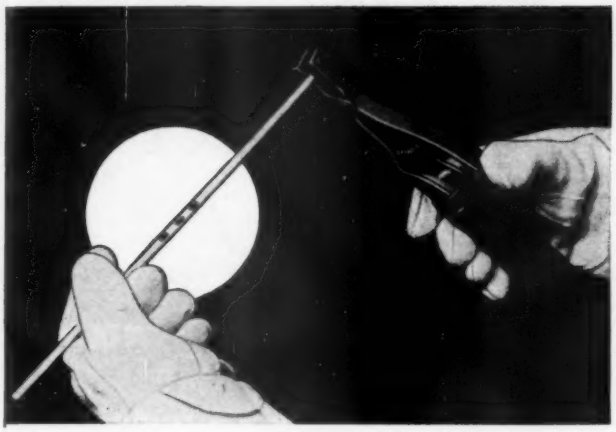
> "We decide, before the battle begins, how we want it to develop. We then force the battle to develop our way. I always aim at making the enemy dance to my tune."

See how this Montgomery strategy can dictate the battle in the field of Arc Welding:

"Force the Battle," *he says*

LOOK, GENERAL, how manufacturers and builders force their "enemy" competitors to dance to the tune of faster and better Arc Welding.

with



"FLEETWELD"

. . . the world's No. 1 electrode family

THREE DOTS

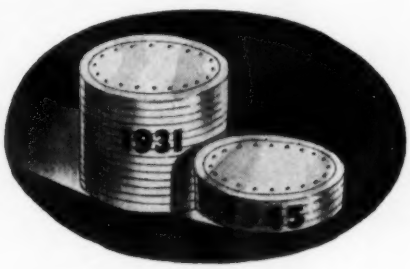
Enables you to identify at a glance the genuine "Fleetweld"

FORCE 1: FASTER and FASTER WELDING

Lincoln Engineers, in constant touch with welding users the world over, provide a fund of ideas for the continuous improvement of "Fleetweld" and the techniques for its use. Result: Deposit rates are faster; spatter and slag loss is less; arc is easier to strike and maintain under all welding conditions and positions.

FORCE 2: HIGHER and HIGHER QUALITY

Every "heat" of wire, every batch of chemicals and every step in "Fleetweld" production is checked carefully by laboratory and production supervisors to make sure that every electrode meets super strict specifications. Continuous refinement of "Fleetweld" has kept it the standard of weld quality the world over.



FORCE 3: LOWER and LOWER COST

Lincoln's increasing large-scale production has made possible installation of the world's most efficient equipment and methods for electrode manufacture. Lincoln has led the world in the reduction of electrode manufacturing cost and has continually passed the savings on to the user . . . for lower and lower welding cost.

Complete details and procedures for eight types of "Fleetweld" and 32 other Lincoln Electrodes are given in the "Weldirectory." Free on request.

THE LINCOLN ELECTRIC COMPANY • Cleveland 1, Ohio

America's greatest natural **recourse**

ARC WELDING

FLEXIBILITY GRAY *Openside* PLANER

One of the outstanding advantages of the Gray Openside Planer is its versatility. Not only does this machine have rigidity for handling the average planer job, but will accommodate odd shaped work and pieces which extend beyond the normal limits of the table. This permits work to be done on a smaller openside than could be handled on a conventional double housing planer.

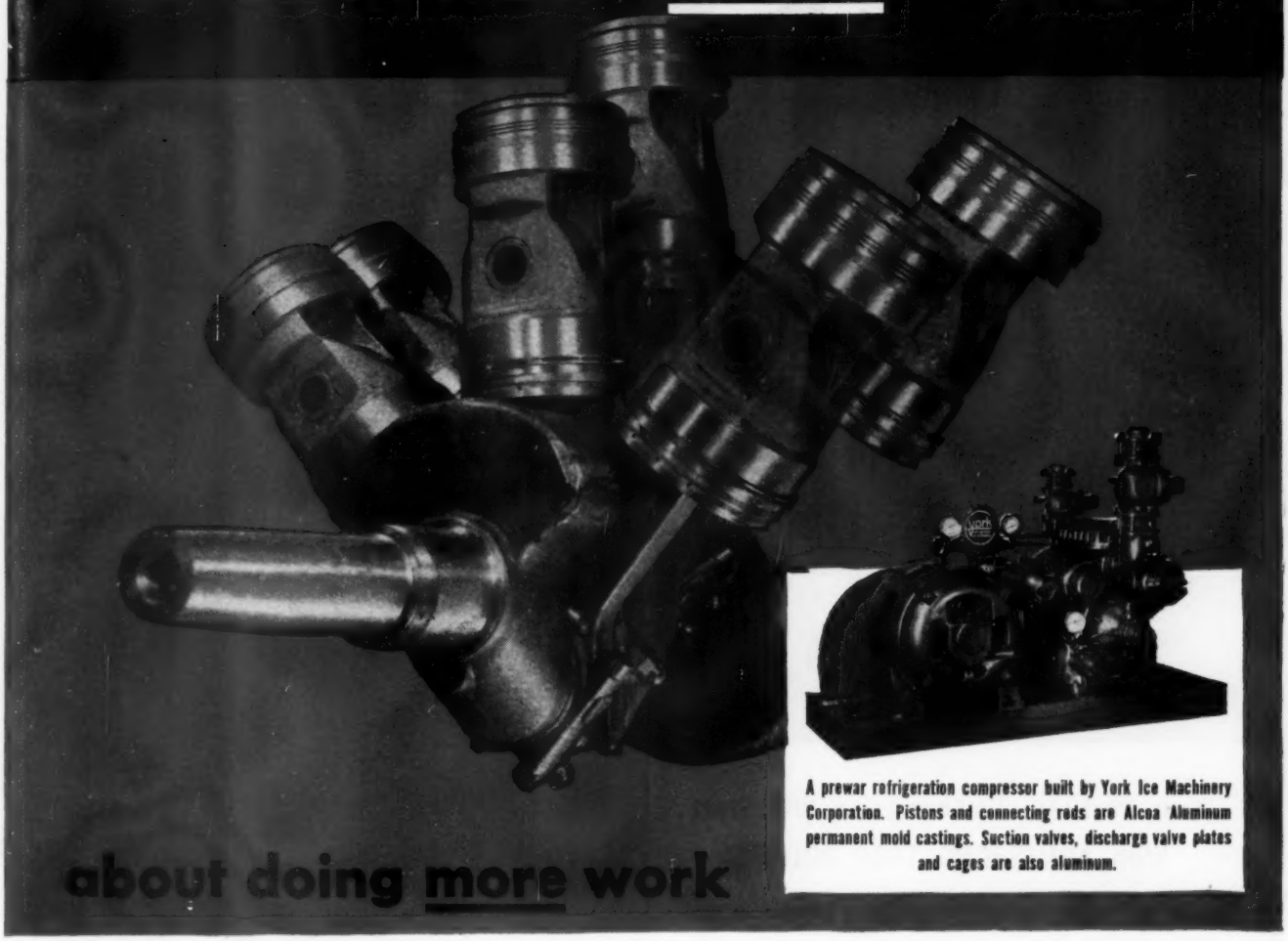
For example, ganging five columns on the table of the Gray Openside Planer and operating three heads at one time as shown. Note how columns extend beyond table.

The massive construction and rigidity insure dependable accuracy on all jobs —large and small—cast iron or steel castings.

THE G. A. GRAY COMPANY
Cincinnati 7 Ohio, U. S. A.

THE GRAY LINE — Double Housing and Openside Planers, Switch Planers, Die Block Planers, Double-Housing and Openside Milling Planers, Planer Type Milling Machines, Horizontal Boring Machines.

IT MAKES LESS FUSS



A prewar refrigeration compressor built by York Ice Machinery Corporation. Pistons and connecting rods are Alcoa Aluminum permanent mold castings. Suction valves, discharge valve plates and cages are also aluminum.

about doing more work

Alcoa Aluminum Alloys help to make this York compressor lightweight and compact

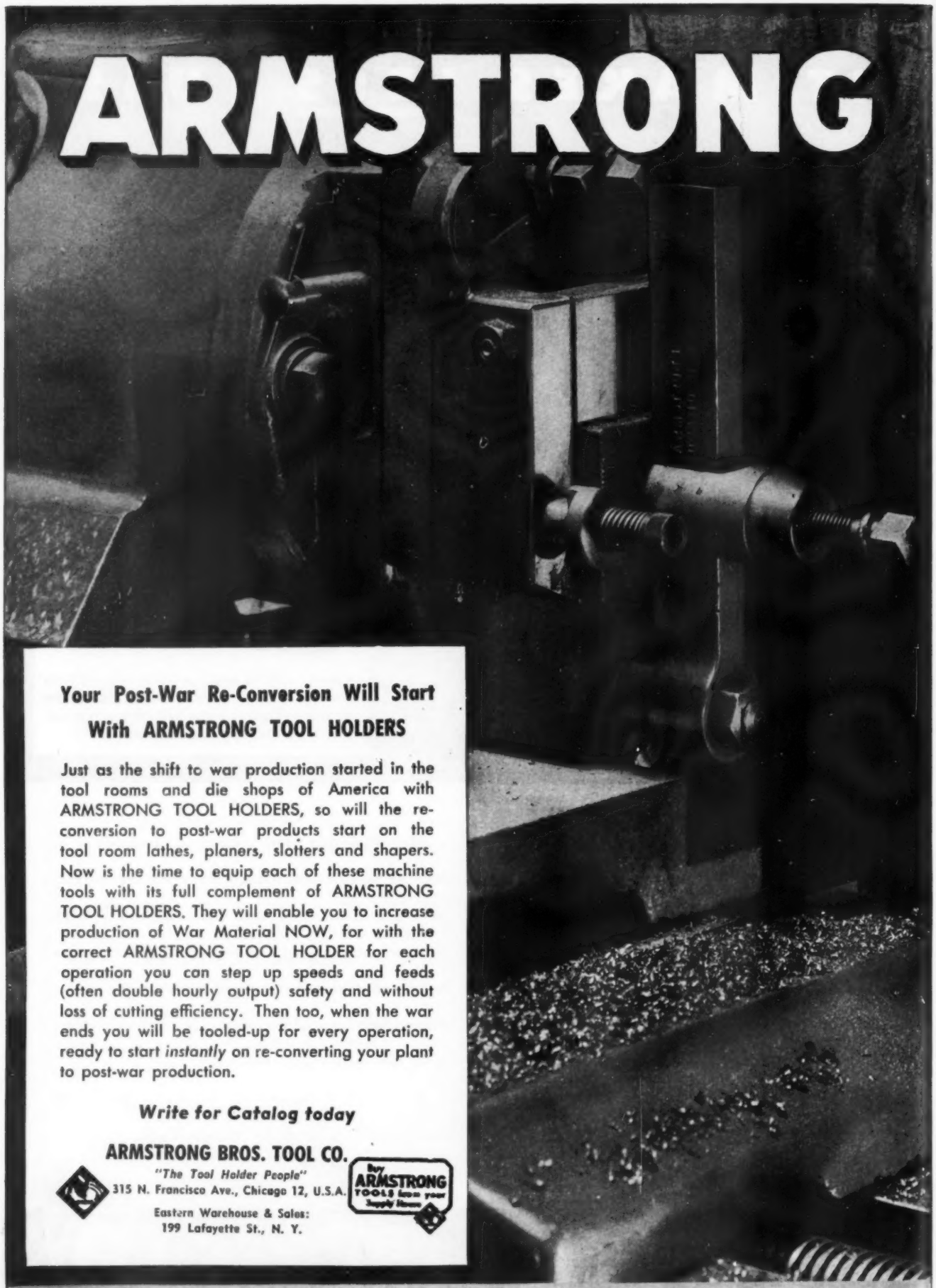
The V/W design has the same crank effort characteristics as does an "in line" cylinder arrangement. The lightweight aluminum pistons and connecting rods reduce reciprocating and rotating weights and make balancing easier, with consequent reduction in vibration. Higher rotative speeds are possible, therefore.

The aluminum alloy connecting rods serve as bearing metal, eliminating the need for bearing inserts at the crank and wrist pins. The high heat conductivity of the pistons helps to reduce compression chamber temperatures. And of great importance here, aluminum works well in contact with the refrigerant, Freon-12.

ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN **ALUMINUM**

ARMSTRONG



Your Post-War Re-Conversion Will Start With ARMSTRONG TOOL HOLDERS

Just as the shift to war production started in the tool rooms and die shops of America with ARMSTRONG TOOL HOLDERS, so will the re-conversion to post-war products start on the tool room lathes, planers, slotters and shapers. Now is the time to equip each of these machine tools with its full complement of ARMSTRONG TOOL HOLDERS. They will enable you to increase production of War Material NOW, for with the correct ARMSTRONG TOOL HOLDER for each operation you can step up speeds and feeds (often double hourly output) safety and without loss of cutting efficiency. Then too, when the war ends you will be tooled-up for every operation, ready to start *instantly* on re-converting your plant to post-war production.

Write for Catalog today

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

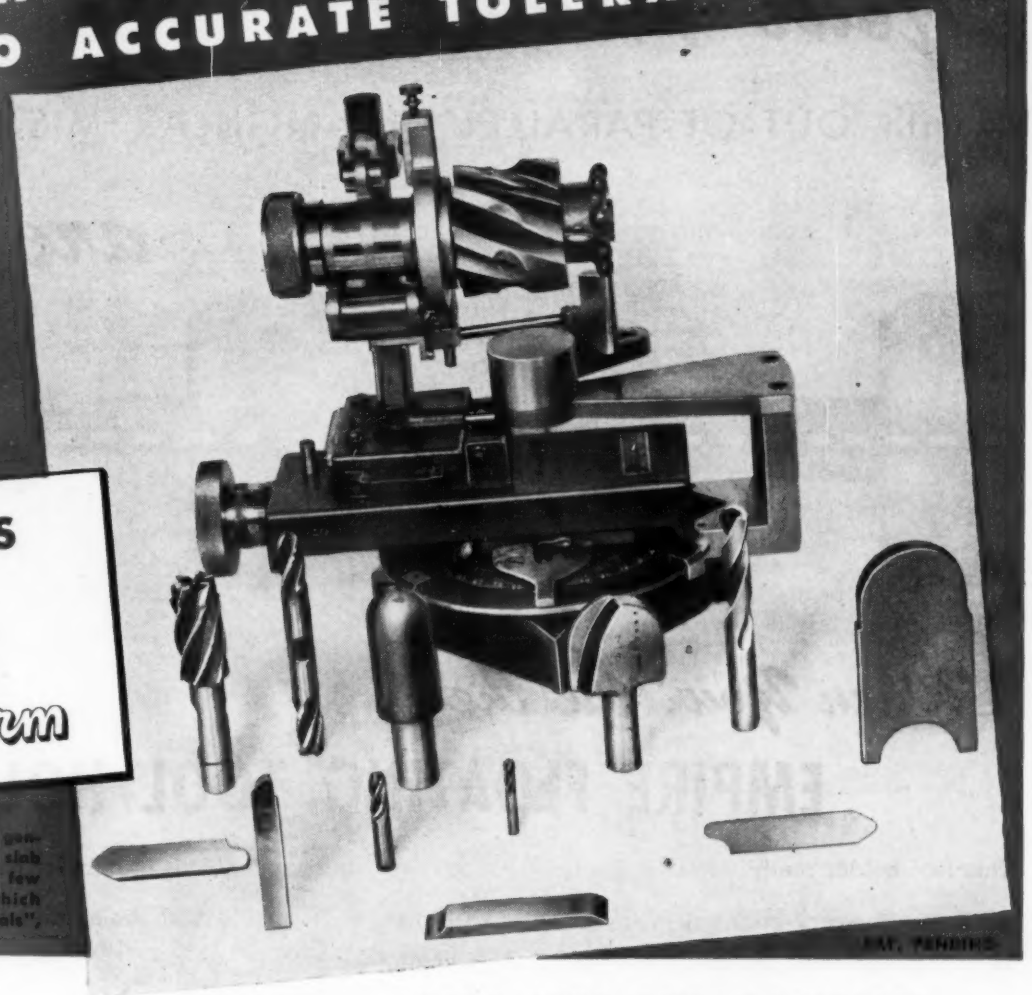
315 N. Francisco Ave., Chicago 12, U.S.A.

Eastern Warehouse & Sales:
199 Lafayette St., N. Y.

Buy ARMSTRONG TOOLS from your Supply House

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

GENERATES CUTTING TOOLS TO ACCURATE TOLERANCES!



MEYERS

Radiform

TRADE MARK REG.

Meyers Radiform set up to generate a radius on a helical slab mill. Also pictured are a few standard cutting tools which have been made into "specials", on the Radiform.

Eliminate Wheel Forming

SAVE TIME AND MATERIALS . . . SPEED PRODUCTION . . .

The Meyers Radiform is unlike any other machine on the market in that it is adaptable to so many different grinding operations. Predetermined radii can be *accurately* generated on tool bits, milling cutters, end mills, drills and die sinking tools in less time than by any other method.

Speed, accuracy and *versatility*—a combination that makes the Radiform indispensable in any shop. Discover what Radiform can do for your shop. Write or wire today for complete descriptive literature and prices.

W. F. MEYERS COMPANY, INC. • *Established 1888*

1022 FOURTEENTH STREET • BEDFORD, INDIANA

Clip

AND MAIL THIS COUPON TODAY!

W. F. MEYERS COMPANY

1022 Fourteenth Street, Bedford, Indiana

Please send catalog and price list on Meyers Radiform Wheel and Tool Former.

*Company*_____

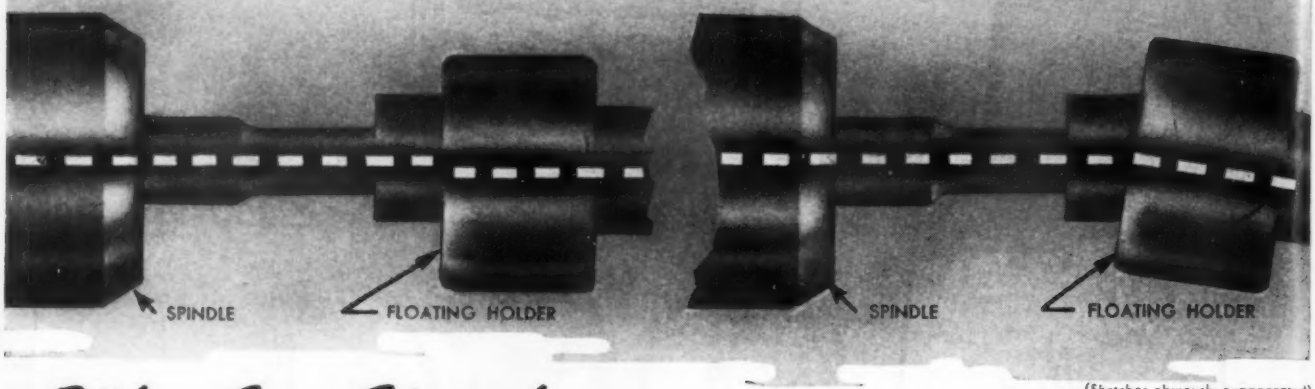
*Address*_____

*Name*_____ *Title*_____

Your Troubles

with OUT-OF-PARALLEL or ANGULAR MISALIGNMENT

are over!



(Sketches obviously exaggerated)

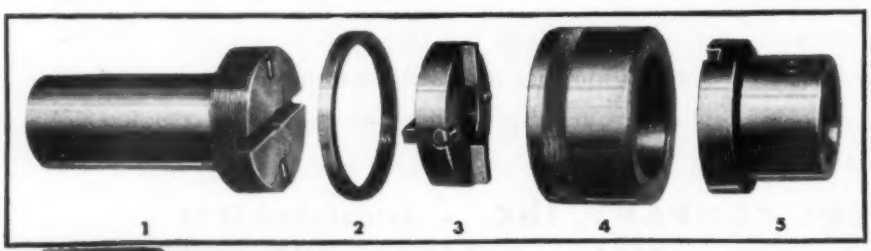
When You Use the

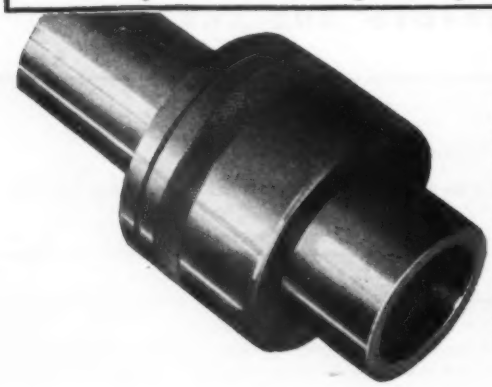
EMPIRE FLOATING TOOL HOLDER

This tool holder really floats!

As a result, every hole you ream—starting with the very first one—will be accurate to size and perfectly round. No more bell mouths! The cap and shank float independently of each other to create a free and easy movement. Composed of only five parts—easily disassembled—the holder has a reduced wear factor.

Available with holes and sleeves in the following sizes: ⅜", ½", ⅝", ¾", 1", 1¼", 1½", with shank diameters: ⅝", ¾", 1", 1¼", 1½", 1¾", 2", 2¼"—for any machines from the smallest Brown & Sharpe Automatics to the largest hand or automatic screw machines.





ONLY **5** PARTS

1* SHANK
2 ADJUSTABLE NUT
3* UNIVERSAL FLOAT
4 BODY (CAP)
5 SLEEVE

*These distinctive features enable Empire Floating Tool Holders to compensate for misalignment *in all directions.*

You can try one for 30 DAYS

If you're not entirely satisfied, return it for full credit.

BUY MORE BONDS

EMPIRE TOOL COMPANY

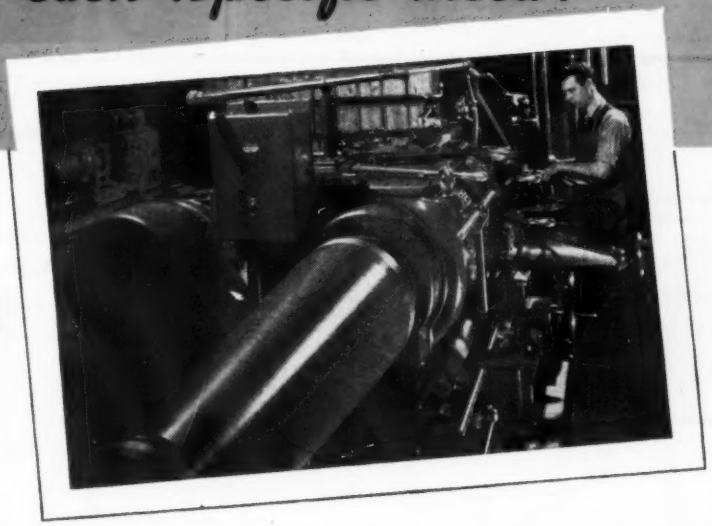
8778 GRINNELL AVE.
DETROIT 13, MICHIGAN

Proved in War use—

There's a

GULF QUALITY RUST PREVENTIVE

for each specific need!



Available now for protecting your surplus equipment

Every type specially suited to provide maximum protection

When you change over from swords to plow shares, make sure your surplus tools and equipment are properly protected against damaging rust.

From Gulf's complete line, you can select one or more war-proven rust preventives that will meet your every requirement for both interior and exterior use—and provide positive protection for indefinite periods.

Gulf quality rust preventives have given an excellent account of themselves in protecting all types of metal parts and war equipment during storage and transportation overseas. They meet Government specifications for exterior and interior application, and are available now for immediate delivery.

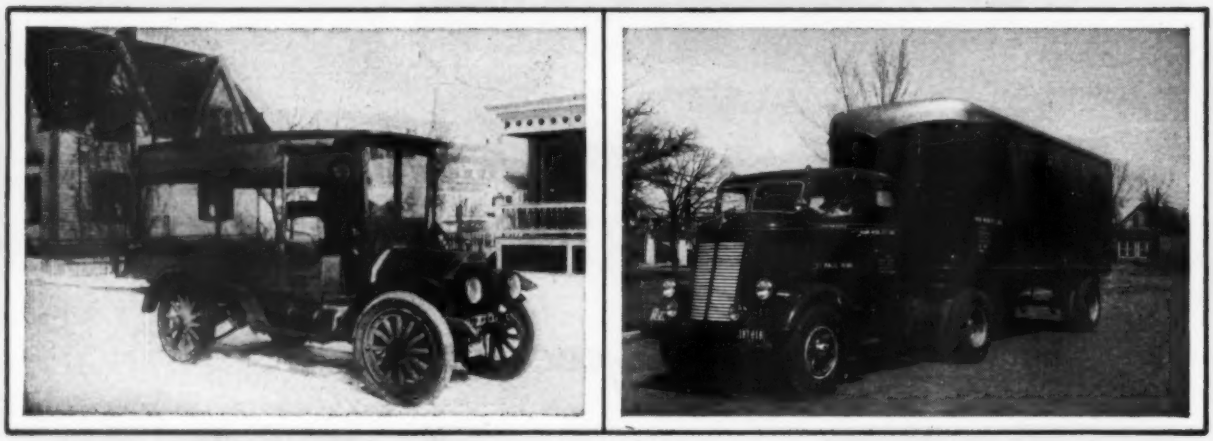
For further information on Gulf quality rust preventives, write, wire, or phone your nearest Gulf office.

Gulf Oil Corporation • Gulf Refining Company

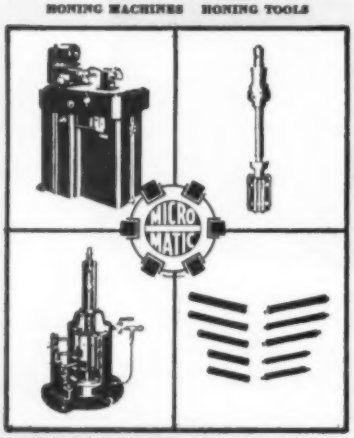
GULF INDUSTRIAL LUBRICATION

Division Sales Offices:
Boston • New York • Philadelphia • Pittsburgh • Atlanta
New Orleans • Houston • Louisville • Toledo

Honing *shared in converting yesterday's "PRIDE OF THE FLEET" into the* MODERN ECONOMICAL TRUCK CARRIER



HONING MACHINES HONING TOOLS



HONING FIXTURES ABRASIVE STICKS

MICROMATIC
HONE CORPORATION
Detroit, Michigan

Yesterday—*Called "slave ships" and "kidney busters" by drivers, yesterday's trucks were hard to drive, costly to operate, and required almost constant service. But with all their crudities, they inaugurated a new era in highway transportation and distribution of goods. Grinding—an early process of controlled abrading—made them possible.*

Today—The powerful modern carrier has higher speed, maximum economy, long periods between overhauls, easy maintenance, a high pay-load factor—the goal of yesterday's builders. HONING, the modern, controlled abrading process, helped engineering design and production achieve this mechanical triumph.

Tomorrow—Today's tough military service and maintenance will be projected rapidly into commercial and industrial use. The competitive movement of bulk-weight shipments will require greater and greater operating efficiency.

In the mechanical refinements to come, HONE ABRADING processes developed by Micromatic will be ready to play a most important part.

MAKERS OF HONING MACHINE TOOLS

Army Transport Now Races
On Honed Working Surfaces

Only yesterday army trucks crawled briefly between breakdowns—because of poor bearing surfaces. Modern carriers—trucks, tankers and prime movers have to be tough to stand the continuous service under heavy going.

They now race dependably on accurately honed working surfaces. Speed and time between overhaul have been multiplied. They are better because of their precision bearing surfaces. Honing assures this surface quality, and eliminates loose bearings, inaccurate fits, fatigue cracks, and other enemies of durability.

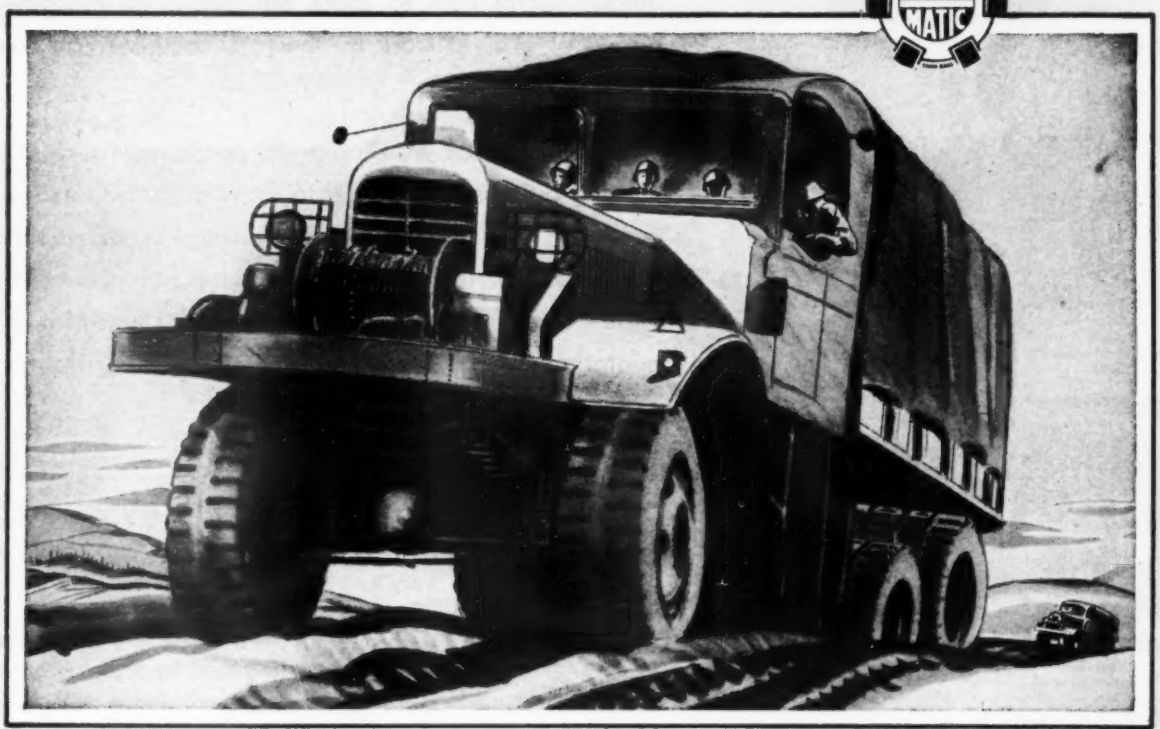
Microhoning—the modern abrading process—removes stock at rates up to 65 cubic inches per hour—generates accuracy for roundness and straightness of bore within .0002″ to .0003″ and any desired surface finish.

Trucks — planes — tanks — jeeps — ordnance — ships — Microhoning has many applications in war . . . and many more in peacetime use. Write for Bulletin A. R. 67.

Some Microhoned Heavy Vehicle Bores

Gas and Diesel Engine Cylinder Bores and Sleeves
Connecting Rod Bores (Large End)
Valve Guide Bores
Diesel Fuel Injector Bores
Shock Absorber Bores
Brake Cylinder Bores
Transmission Gear Bores
Ditching Machine Planet Gear Bores
Roller Tooth Steering Sectors and many other parts.

MICRO MATIC



Courtesy Mack Truck

MICROMATIC HONE CORPORATION

DETROIT, MICHIGAN

THE *SPEED* WAY TO INSPECT ± DIMENSIONS

In sets to fit your need—
SCHERR
Adjustable Limit
SNAP GAGES

FOUR COMPLETE SETS
6, 10, 12, or 19 gages

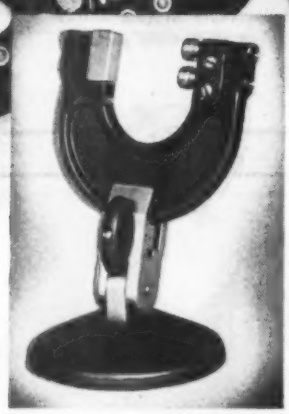
These sets permit instant inspection with minimum dependence on operator's skill. The untrained operator quickly learns how to check dimensions on machined, turned or ground work by the fast, accurate "go" and "no-go" method.

Frames are of Meehanite for unchanging rigidity. Gaging buttons are lapped to parallelism with extreme accuracy. Gages shipped unsealed and unset, or set to specified size. In two types — Type A, as above, and Type C with solid anvil, as shown at left. Special anvils, quotation on request. Immediate delivery.

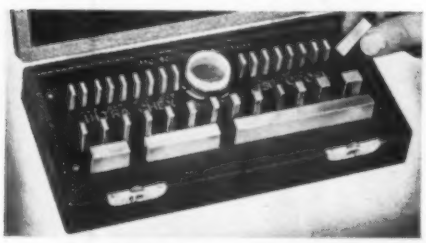
SET No. 1—Six gages, Type A—0 to 3".....$34.83
SET No. 2—Ten gages, Type A—0 to 6".....$66.15
SET No. 3—Twelve gages, Type C—0 to 3 1/16".....$82.51
SET No. 4—Nineteen gages, Type C—0 to 5 11/16"...$146.77

•

Scherr Adjustable Limit Snap Gages are made with all care to sustain the quality reputation held by Scherr products for the past quarter-century. Descriptive bulletin on request, or order direct.



***TO SPEED UP GAGING,** use the Scherr Tool Stand, which frees both hands of operator, and prevents transmission of body heat to the gage. Adjustable clamp holds the gage firmly in the desired position, and the heavy base prevents movement. A definite advance in time saving. Price, $7.50.*



***TO SET GAGES ACCURATELY** use a set of Scherr Ultra-Chex Gage Blocks giving you 80,000 combinations in steps of 1/10,000 in. Essential in every shop, and within the budget of any shop at $125.00.*

GEO. SCHERR CO., Inc. 201 LAFAYETTE STREET NEW YORK 12, N. Y.

OUTSTANDING TOOL LIFE

BARBER-COLMAN

HOBS • HOBBING MACHINES • HOB SHARPENING MACHINES • MILLING CUTTERS
REAMERS • REAMER SHARPENING MACHINES • SPECIAL TOOLS

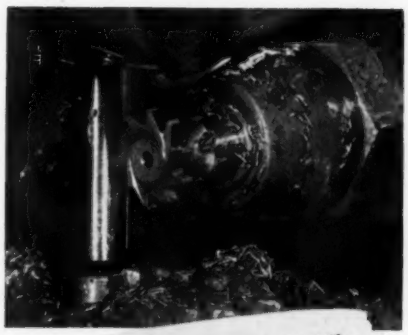
MILLING CUTTERS

"3500 CRANKSHAFT ENDS PER CUTTER SHARPENING IN 3120 STEEL FORGINGS, 201-235 BRINELL".

Illustrated here are a few examples of the various types of Milling Cutters manufactured by Barber-Colman Company, together with brief indications of the outstanding performance they are delivering. Additional information will be supplied upon request.

A large stock of Standard Cutters is carried for immediate shipment, and within a few hours after your order is received, the specified tools will be on their way to your plant. Should you require End Mills, Plain Mills, Side Mills, Saws and other Profile Cutters, differing slightly from standard, BARCOL specially engineered CUTTERS for your particular problem can be furnished on SHORT DELIVERY.

Why not bring your 1945 Cutting Tool Files up-to-date by writing today for a copy of our complete Milling Cutter Catalog ML.



HY-TEN 3B STEEL, 38-40 ROCKWELL, MILLED 35 PIECES PER GRIND WITH B-C KEYSEAT STANDARD CUTTERS. SLOT WAS .127" x 5/64" x 15/16" LONG".

"BRAKE SHOES MILLED IN TOUGH CAST STEEL; 192 BRINELL, FREQUENT HARD SPOTS, AT RATE OF 187-220 PIECES PER CUTTER SHARPENING".

"PLUNGE CUT 15,000 PIECES IN 1/2 HARD BRONZE, .276" WIDE x .690" DEEP WITH B-C 4-FLUTE SPIRAL END MILLS".

"STEEL CASTINGS, 241-285 BRINELL, 104 PER SHARPENING, MILLED WITH B-C IMPROVED INTERLOCKING CUTTERS, REMOVING 1/8" STOCK IN CUT 1-27/32" DEEP x 1-1/4" WIDE x 2-11/32" LONG".

Accurate! *Dependable!*

Barber-Colman Company

GENERAL OFFICES AND PLANT 111 LOOMIS ST., ROCKFORD, ILLINOIS

THE TOUGHER THE SERVICE THE BETTER THE TEST...

Many small tools are capable of handling easy jobs with a certain degree of efficiency and economy, whereas on the tough job they might not stand the gaff.

Today, most jobs are tough, calling for tough tools. Then too, because of small tool shortage, all tools must sooner or later be assigned to gruelling service making it imperative that every small tool be capable of maximum performance in long, hard work.

The test of UNION TOOLS is to put them to work under today's conditions and let results dictate the tools you buy. On such a basis UNION will be the "Tools You Buy Again."

THE UNION LINE

Twist Drills—Milling Cutters—Reamers—Hobs—Slitting Saws — End Mills — Taps — Dies — Screw Plates—Profile Cutters.

UNION TWIST DRILL COMPANY, ATHOL, MASS.

STORES New York Store: 61 Reade St.; Los Angeles Store: 524 East Fourth St.; Chicago Store: 11 So. Clinton St.; Seattle Store: 568 First Ave., So.; San Francisco Store: 121 Second St.; Detroit Store: 5527 Woodward Ave.

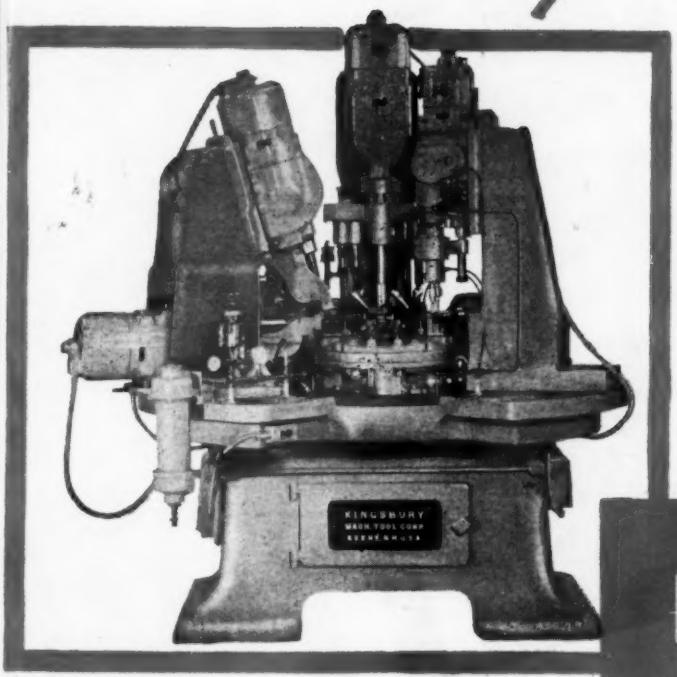
MANUFACTURING DIVISIONS

S. W. Card Mfg. Co., Div.; Mansfield, Mass.

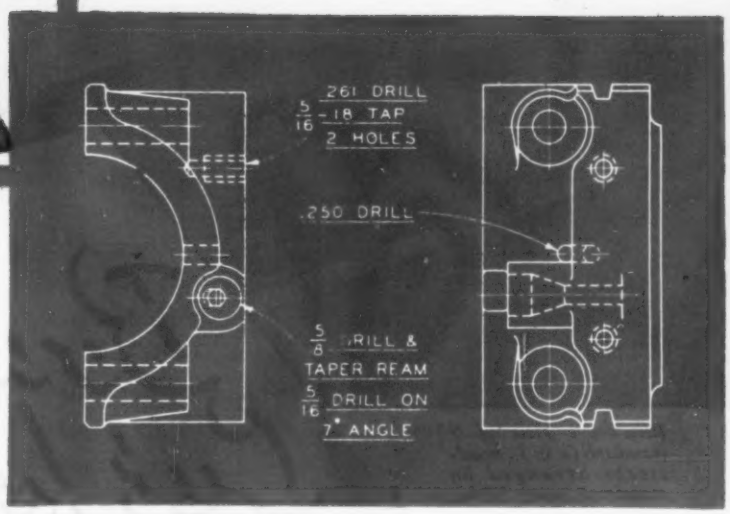
Butterfield Division, Derby Line, Vt., and Rock Island, Quebec

UNION

FLEXIMATIC
by KINGSBURY



Three operations from three different directions handled in a single chucking of the work .....



The advantage of the KINGSBURY FLEXIMATIC method for performing various machining operations in a single chucking of the work is exemplified here. The parts involved are automobile rear main bearing caps which are drilled, reamed and tapped on a Model GD FLEXIMATIC from three different directions without rechucking. All operations occur simultaneously during unloading and loading.

Obviously, ability to handle work of this nature in the way it is handled on a FLEXIMATIC means outstanding production capacity. To this advantage must be added the precision which characterizes FLEXIMATIC performance—a combination which is of such outstanding value today because it makes every minute count in high speed precision production. Furthermore, KINGSBURY FLEXIMATICS conserve man power through the ability of one operator to easily out-step the productivity of several men on general purpose machines.

Basically, the FLEXIMATIC is an automatic indexing machine built up of a number of standard specific operation units in such a way that *all* operations can be performed in a single chucking of the work. By the Kingsbury-pioneered FLEXIMATIC method, unique, flexible and versatile machines are available not only for fast, accurate production but also for quick set-up and convenient change-over.

KINGSBURY MACHINE TOOL CORPORATION
KEENE NEW HAMPSHIRE U S A

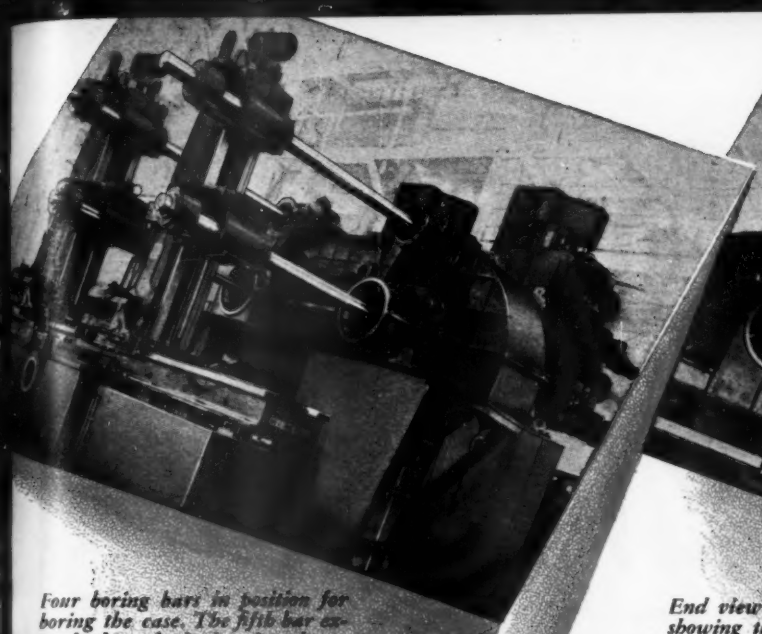
Bird's-eye view of 5 standard G. & L. headstocks arranged on standard units, boring marine turbine reduction gear cases.

Boring Time Cut from 488 to 39 Hours

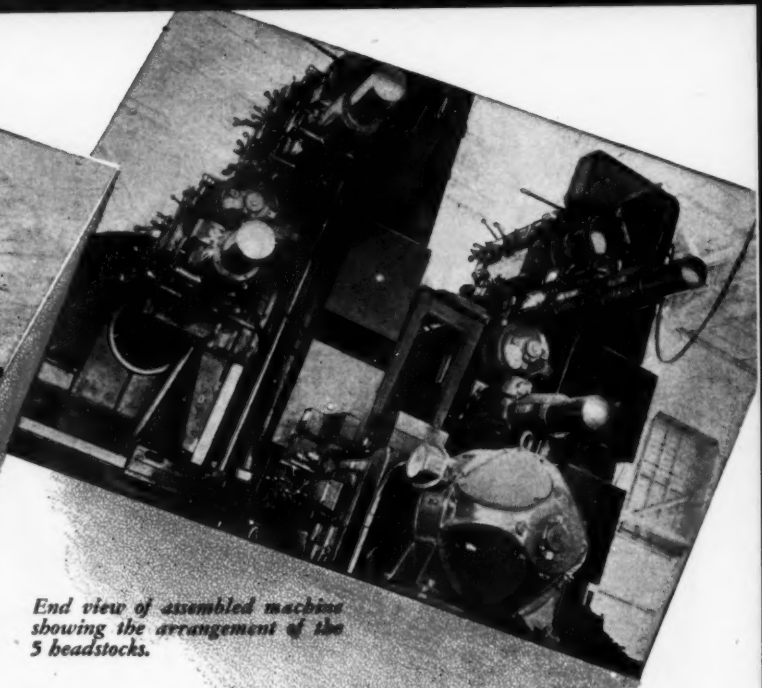
GIDDINGS & LEWIS
138 DOTY STREET

Right: G. & L. Table Type Machine.

Right: G. & L. Floor Type Machine.



Four boring bars in position for boring the case. The fifth bar extends through the bearing shown directly beneath the two end supports.



End view of assembled machine showing the arrangement of the 5 headstocks.

Standard G. & L. Headstocks on Standard Machine Units Bore 5 Bearings Simultaneously in the Time Usually Required for 1

The combination of five Standard headstocks on Standard units cut floor-to-floor production time on this gear case 449 hours. This tremendous saving was made possible by boring the 5 housing bearings simultaneously. The main bearing in the gear case is 35″ in diameter and 24″ in length. While the main bearing is being bored, two intermediate bearings, 16″ in diameter and 14″ long, and two upper pinion shaft bearings, 12″ in diameter and 10″ long, are completed. All five bores are finished in the time it takes to bore the main bearing.

Center Distances are Fixed and All Bores are in Accurate Alignment

The reduction in the machining time was made possible by fixing the headstocks and columns so all bearings are bored in one setup of the gear case, without the necessity of making any settings or adjustments. No time is lost in gaging the bores for correct spacing and parallel alignment. In addition to the saving in floor-to-floor time, the high degree of accuracy of the finished case permitted further substantial savings in the assembly of the gears, and made the various components interchangeable.

Should the dimensions of the gear case be changed at any time, all units can be relocated to suit the new conditions, and should the building of marine reduction gear cases be discontinued entirely, the machines can be separated into four complete Standard No. 360 Floor Type G. & L. Horizontal Boring, Drilling and Milling Machines with 6″ spindles, and one No. 560 Headstock with boring bar supports for 10″ diameter bars.

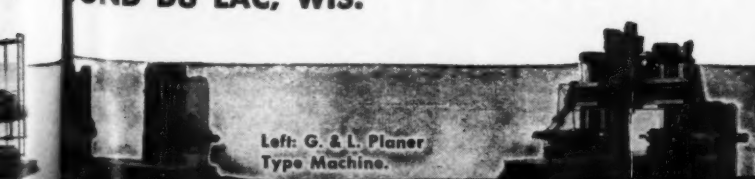
If your production demands machining work of this character, you too can profit by using G. & L. Horizontal Boring, Drilling and Milling Machines. Consult Giddings & Lewis engineers to help solve difficult machining jobs. There is no obligation for this service.

Additional Data

...covering the complete line of Giddings & Lewis machines and time-saving accessories is included in this catalog. Write for your free copy today — please indicate your business connections. Ask for Bulletin No. AM-35.

MACHINE TOOL CO.

FOND DU LAC, WIS.



Left: G. & L. Planer Type Machine.

Left: G. & L. Multiple

CINCINNATI HYPRO PLANERS AT WORK FOR VICTORY . . . "Down Under"

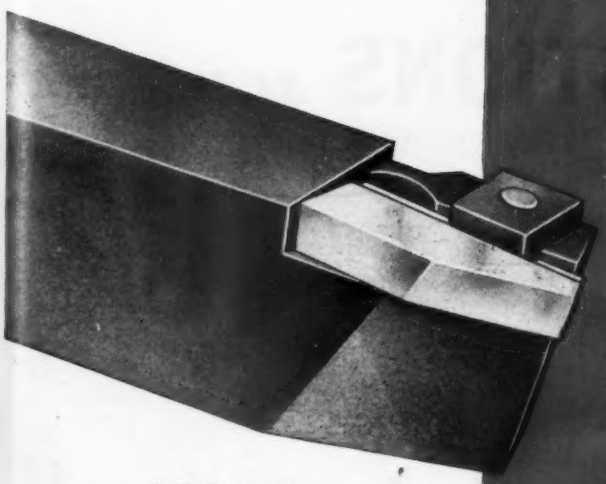
● When this picture was taken two years ago Cincinnati Planers down under were confined to Australian shops. Our former employees in the service write us that they now meet Hypros in many a spot where machine tools were never seen before. They report the soldiers and sailors operating them are giving their Hypros good care.

● Our armed forces have discovered what American manufacturers have known for 45 years . . . . . that CINCINNATI Planers machine parts fast and accurately . . . that they are designed to withstand the heaviest cuts at more than rated motor speed . . . and that the Hypro Herringbone Drive provides unparalleled smoothness of operation. Ask for our new General Catalog.

THE CINCINNATI PLANER COMPANY

Planers... Vertical Boring Mills... Planer Type Millers

CINCINNATI . OHIO . U.S.A.

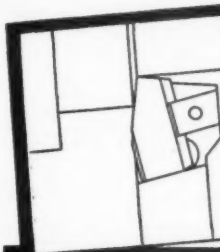


STYLE 12 HD
(OPPOSITE HAND-STYLE 11 HD)

Introducing—

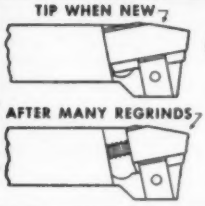
KENNAMETAL "HD" TOOLS

WITH CLAMPED-IN, ADVANCEABLE KENNAMETAL TIPS



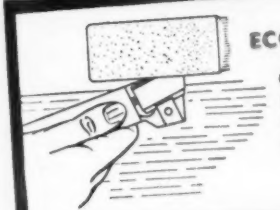
"HD" TIPS ARE STRONG

Tip is firmly supported—underside is diamond ground, and rests on plane surface of recess which is finished true with Kennametal Milling Cutter or End File. Thermally strain-free assembly also helps prevent tip breakage.



MAJOR PART OF TIP USED

When dull, tip can be advanced, and resharpened time and again, until the major part of it has been used.

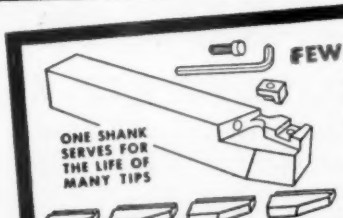


ECONOMICAL REGRINDING

Only the tip is reground—no shank steel is removed. Operation is fast—clogging of diamond wheel grinder with steel is prevented.

STREAMLINED DESIGN

Smooth, unimpeded chip flow assured by improved clamping arrangement, correctly positioned. HD design employs pressures set up in cutting as factors to help hold tip in place.



FEWER TOOLS REQUIRED

Many tips can be used during the life of a shank, and tip of suitable Kennametal composition can be used for each job.

for HEAVY-DUTY Machining on Steel and Cast Iron

Kennametal HD Clamped-On Tools make practicable high rate carbide machining on heavy steel forgings, castings, and bar stock, and cast iron, because the strength of the special HD tips and the perfected design of the tool enable deep cuts and heavy feeds to be taken at intermediate speeds, with amazing tool life.

HD Tools are now available in two styles —11HD and 12HD—for heavy duty turning and boring operations, with special HD tips in Grade KM for general steel cutting, Grade K2S for machining very rough or scaly steel castings, and Grade K6 for cutting cast iron. Larger sizes, i.e., with shanks 1" to 2" wide, are now being produced.

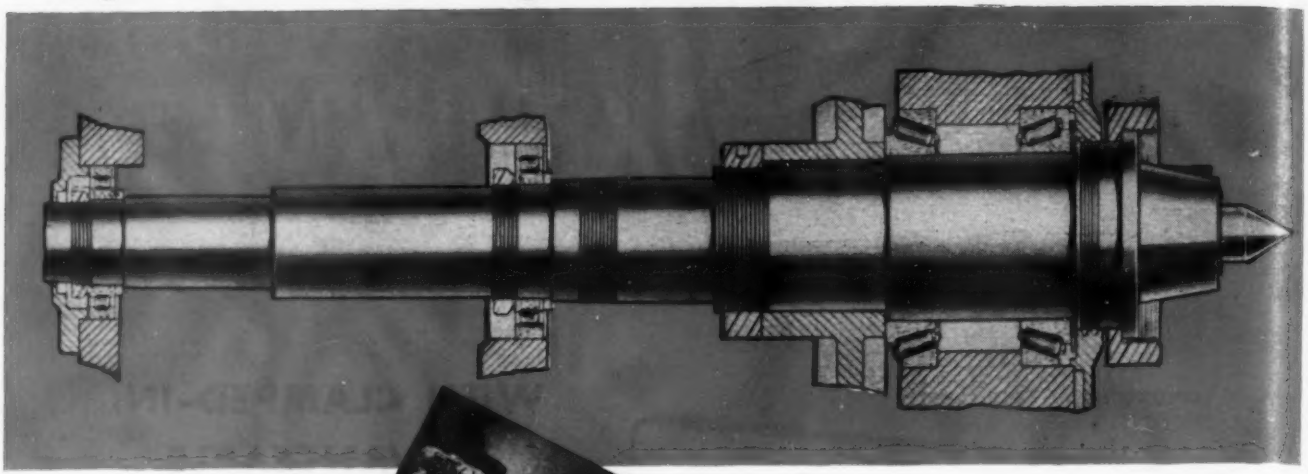
Catalog information, and prices, will be sent immediately upon request.

KENNAMETAL

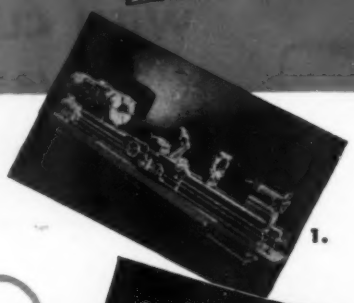
SUPERIOR CEMENTED CARBIDES

KENNAMETAL Inc. LATROBE, PA.

TURNING QUESTIONS *answered!*



1. 27" Hollow Spindle Lathe
2. 40" Big Swing Lathe
3. 16" Tool Room Lathe
4. 13" Regal Turret Lathe



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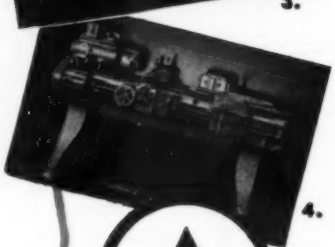


4.

LEBLOND FIELD ENGINEERS

are prepared to help you in your development work, particularly along the lines of the difficult, the out-of-the ordinary turning problems. The accumulated knowledge of every manufacturing trend in good times and bad—peace and war gained over a period of nearly 60 years from thousands of installations all over the world, is yours for the asking. Contact our nearest dealer or write Department FE 46.

WHY A THREE-BEARING SPINDLE?

Because it maintains eight times the rigidity of a two-bearing spindle. Reduces weight drag, cutting pressure and wear. Runs true under hard grueling service. Tapered front bearing provides pre-loading thrust greater than the heaviest working pressure of the lathe. The pre-loaded, pressure-adjusted center bearing insures precision performance and proper load distribution at the rear. That is why LeBlond lathes are equipped with a Three-bearing Spindle. It is one of the many features found on LeBlond lathes. It is just one of the many reasons why LeBlond lathes are preferred by men who know precision-made machine tools.

★ SINCE 1887 ★

the world has been turning to LeBlond for turning equipment.

WRITE FOR CATALOG!

ARMY E NAVY ★ YOUR BONDS BUY BOMBS ★ BUY A "BLOCK-BUSTER" TODAY! WAR

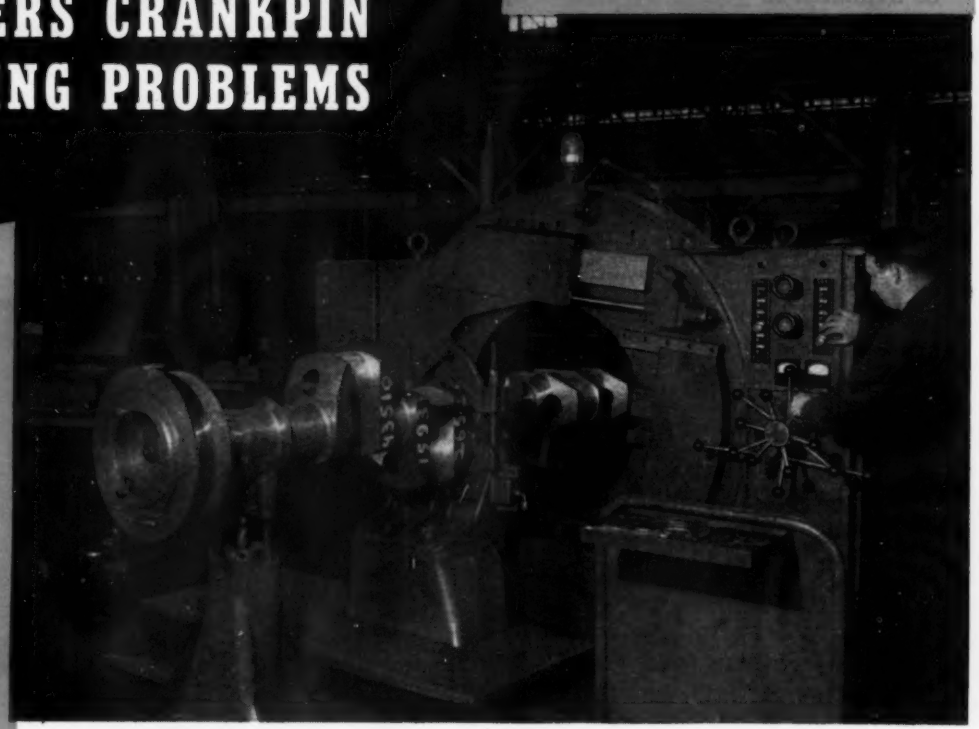
THE R. K. **LeBLOND** MACHINE TOOL CO., CINCINNATI 8, OHIO, U. S. A.

NEW YORK 13, 103 Lafayette St., CAnal 6-5281
CHICAGO 6, 20 N. Wacker Dr., STA 5561

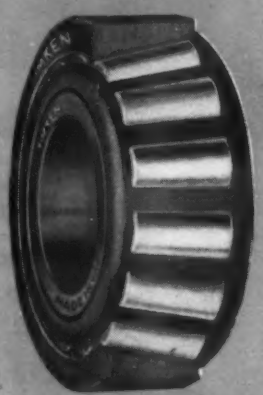
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

TIMKEN
Bearing Equipped Machine
MASTERS CRANKPIN TURNING PROBLEMS

Tapered Roller TIMKEN BEARING EQUIPPED



Size No. 40 Beloit Crankpin Turning Machine turning Diesel engine crankpins in the Diesel Engine Plant of Baldwin Locomotive Works. 38 Timken Bearings are used in this model.



The unique Beloit Crankpin Turning Machine can machine crankshaft bearing pins in from one-fourth to one-half the time required by other methods—and hold to tolerances well within .001".

Designed for higher speeds and heavier cuts, this machine makes possible increased production at lower cost. Metal can be removed faster and because of its accuracy scrap is reduced to the vanishing point.

Beginning with a mechanically correct design, the machine manufacturer has taken every precaution to assure peak performance under all conditions. Thus a considerable number of Timken Bearings — as many as 40 in the largest model machine — is used to increase operating speed; promote precision; give full protection against radial, thrust and combined loads; simplify lubrication and reduce maintenance.

Beloit Iron Works, Beloit, Wisc. is very familiar with the application and advantages of Timken Bearings, having used them for years in their regular line of paper making machinery. They know it pays to use them. See that the trade-mark "TIMKEN" is on every bearing you use.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO

Special-Purpose Machine Efficiency
at STANDARD MACHINE PRICE

The only reason for buying special machines is to gain special production advantages, yet, these advantages may be available to you at savings of up to 50% of special machine cost.

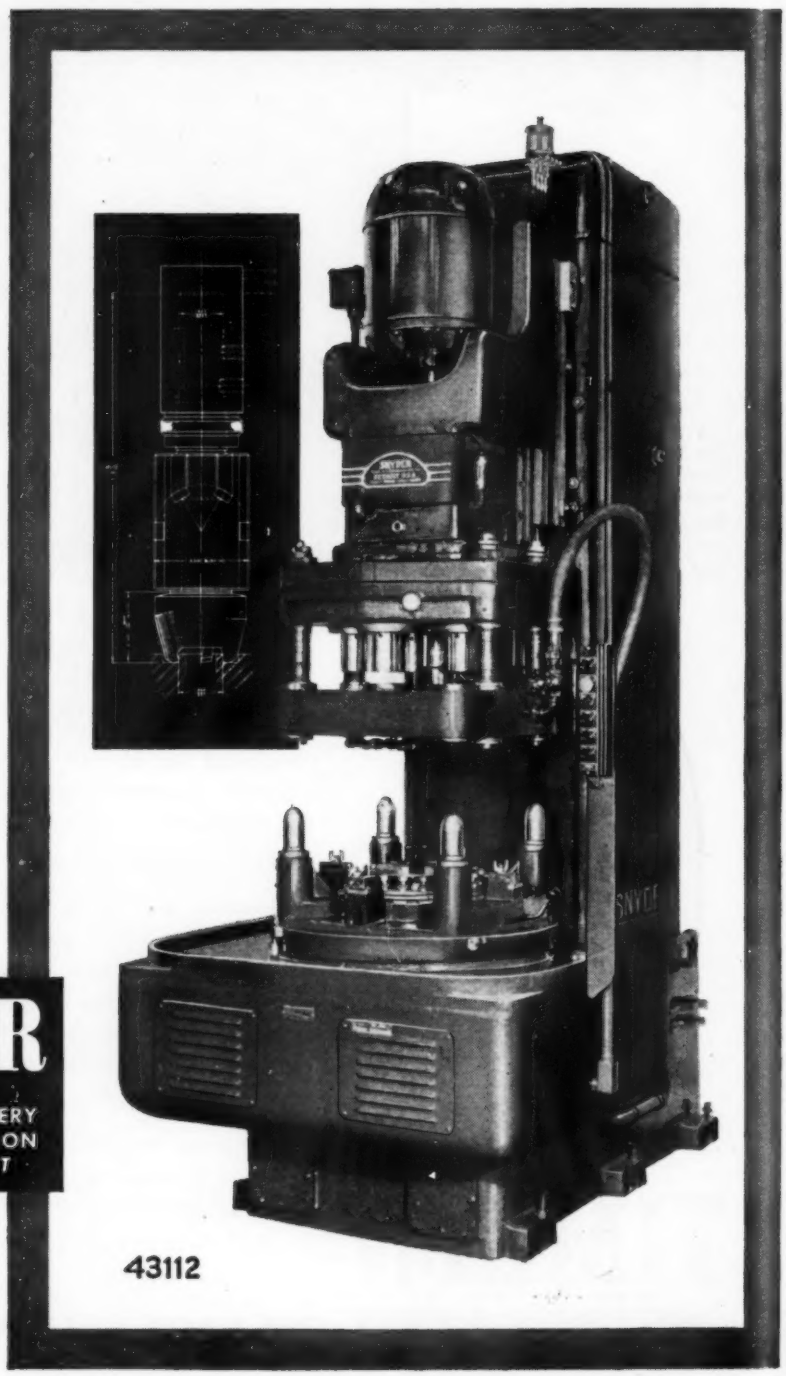
Here's an example. This Snyder standard 10 V 18 drilling machine is a general utility machine, yet, it can be adapted to do many jobs with "special machine" efficiency, speed, and economy of time and labor, through the use of special fixtures, heads and tools.

The machine shown is used to do a hollow milling job on 20 bosses, using a 5-spindle head and 4 indexes to complete the work cycle.

The index table housing serves as a chip trough and coolant retainer. The standard index mechanism provides the smooth acceleration and deceleration of the Geneva wheel, hydraulically powered from the hydraulic system of the machine itself.

This machine is available with or without special tooling and speed change transmission for single or multiple spindle adaptations. Only the equipment is special, and, with such equipment this machine is the equivalent of a special—at about half the cost of such a machine. This machine can be readily re-tooled for entirely different production by changing the special equipment only. If production is your problem, write, wire or 'phone *Snyder Tool & Engineering Company, 3400 E. Lafayette Ave., Detroit 7, Michigan.*

Snyder Standard Drilling Machine with Special Equipment Saves Up to 50% of Special Machine Price



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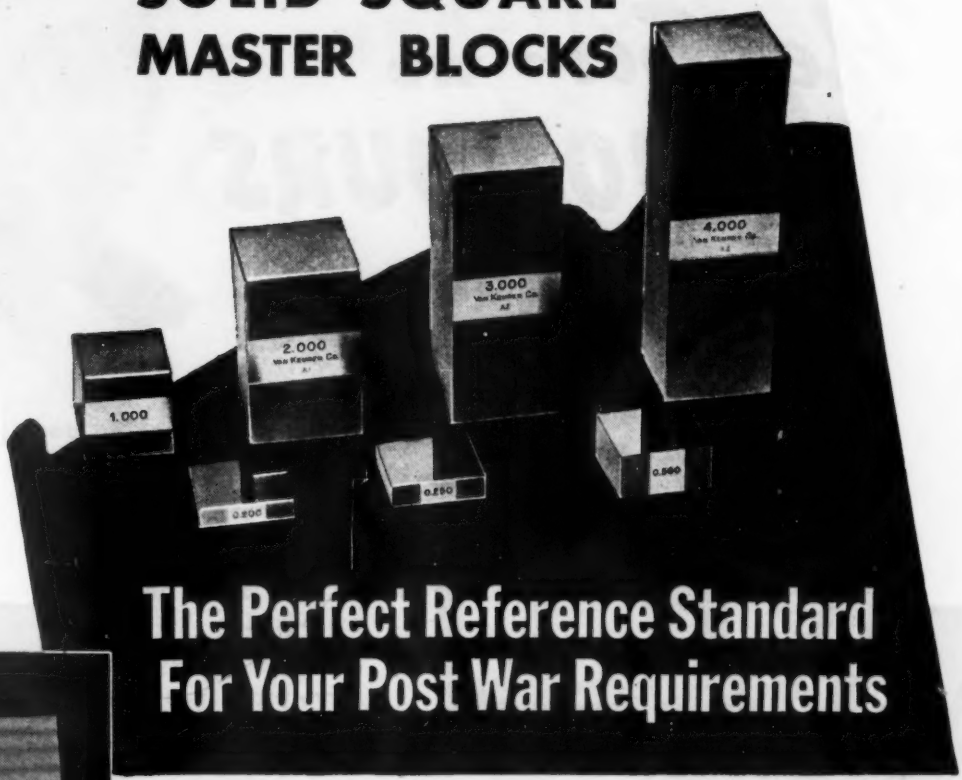
SNYDER
DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST

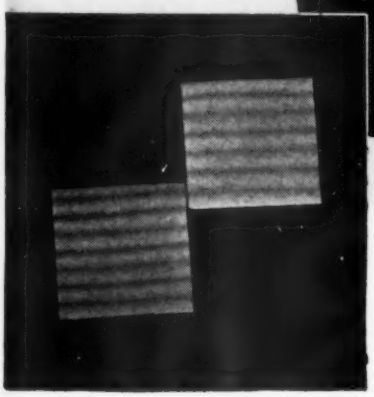
20 Years of Successful Cooperation with Leading American Industries

Van Keuren

SOLID SQUARE MASTER BLOCKS



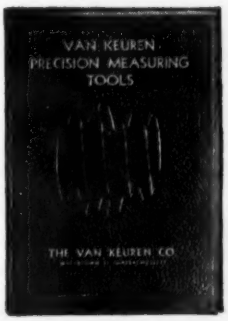
The Perfect Reference Standard For Your Post War Requirements



Comparison of two Solid Square Master Blocks for length, flatness, and parallelism with light waves. Note the straightness, parallelism, and even spacing of the bands on both blocks showing perfection well within the guaranteed accuracy of 4 millionths of an inch. These blocks are ideal standards for making measurements with light waves.

The perfect gage block should be square in order to obtain stability and the best distribution of wearing surface. It should be solid in order to have uninterrupted flat and parallel measuring surfaces. The material should be steel, the best obtainable, in order to secure proper expansion characteristics, maximum wearing qualities, resistance to corrosion, and permanency. These requirements are fulfilled in Van Keuren solid square master blocks. They have six times the life of ordinary blocks and are as nearly perfect as 25 years of experience in manufacturing gage blocks can make them.

A limited number of 41 and 84-block sets are available for quick shipment. Ask for prices and delivery dates. Send for new 144-page Van Keuren Handbook No. 32.



Van Keuren

CO., 176 WALTHAM ST., WATERTOWN, MASS.

Light Wave Equipment—Light Wave Micrometers—Gage Blocks—Taper Insert Plug Gages—Wire Type Plug Gages—Measuring Wires—Thread Measuring Wires—Gear Measuring System—Shop Triangles.

Yes Sir – we SAVED 10 HOURS on this job!

9 surfaces milled simultaneously and held to accurate distances.

Straddle milling job on Kempsmith Type G Milling Machine.

"Instead of knocking down the cutter and arbor set-up for this straddle-milling job, we did the sensible thing—we kept the complete set-up intact, ready for the next production run. The initial set-up required 10 hours . . . so we'll again be saving that much time on the next lot."

Today, especially, it's vitally important to conserve production time. It takes many hours to reconstruct multiple cutter assemblies. Save this valuable time by laying aside the complete set-up for the next run. Have an extra supply of arbors on hand for this purpose. Remember, arbors are "perishable" tools and their cost today is relatively small. That's why —

It always pays to SAVE THE SET-UP!

Kempsmith Arbors are available in all popular sizes and types, adaptable to any make of milling machine with standardized spindle. Mail coupon for literature.

THE KEMPSMITH MACHINE CO.
1823 S. 71st STREET MILWAUKEE 14, WIS., U. S. A.

Arbors BY KEMPSMITH

Precision Built Milling Machines Since 1888

Write Today!

KEMPSMITH — Yes, I would like to receive a copy of your new Arbor Bulletin:

NAME..... TITLE.....

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A 4653-1P-C

FASTER PRECISION TAPPING with ground-thread CIRCULAR CHASERS

One tap body . . . change these parts . . . for complete range of 3" to 5" tapping

Remove the handle of the stationary tap, and it becomes a rotating tap.

Trigger-quick action collapses the tap instantly when the required depth has been reached—no jammed threads and no damaged chasers.

Circular Chasers turn out threads of unquestioned accuracy at high production speeds. And because chasers may be reground through 270° circumference, they last 20 to 50 times longer.

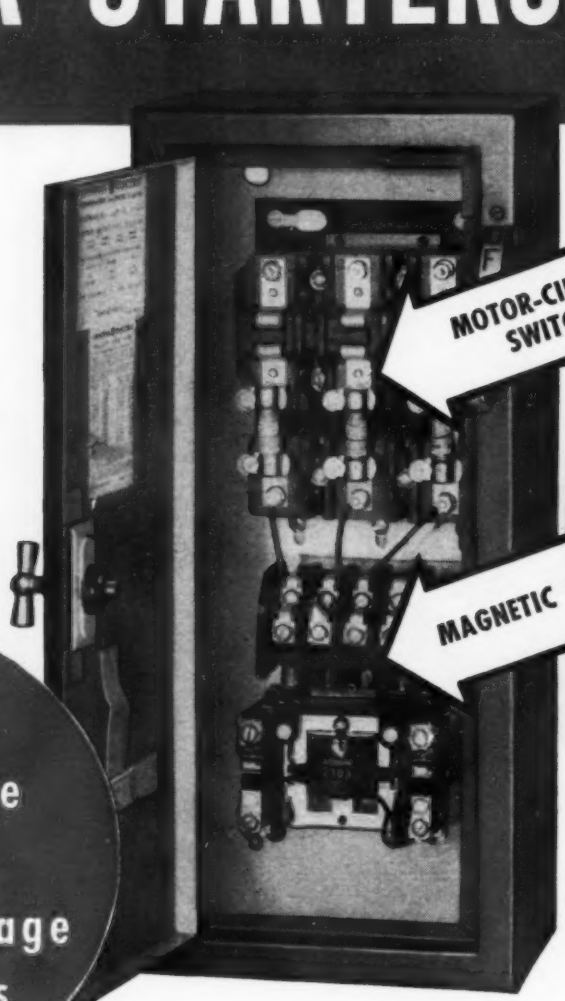
Write us for further money-saving advantages—on *any* tapping job.

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley 4-6 and 8 Spindle Bar and Chucking Automatics • Single Spindle Automatics • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

MOTOR STARTERS EVERY TYPE,



TWO ★ DEVICES ★ IN ONE ★ UNIT

For full-voltage starting of squirrel-cage a-c motors

COMBINATION STARTERS HELP YOU SAVE 6 WAYS

1. THEY SAVE MONEY—List price slightly more than for two separately mounted devices, but the difference is more than made up by the savings in wire, conduit, fittings, and installation costs.

2. SAVE ORDERING TIME—Instead of buying two separately mounted devices, you buy one factory co-ordinated unit that controls and protects your motor.

3. SPEED UP INSTALLATION—Users report a 50 per-cent reduction in mounting time, a 40 per-cent reduction in wiring time, as compared with the installation of two separate devices. You connect only 9 terminals—not 15.

4. SAVE WALL SPACE—You can mount combination starters in small, unused places either near to or remote from the operator.

5. CONSERVE MAN POWER—By eliminating one complete mounting job on every installation, you save valuable man power.

6. SAVE CRITICAL MATERIALS—Combination starters have less copper wire, steel conduit, and fittings than separately mounted devices.

—And they save your motors, too. The fuses, or the breaker, are co-ordinated with the thermal overload relays to give the complete motor protection under short-circuit or overload conditions.

Buy all the BONDS you can—and keep *all you buy*

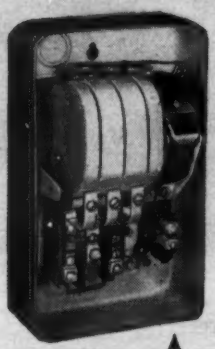
EVERY KIND, FOR EVERY MACHINE APPLICATION

★ DEPENDABLE

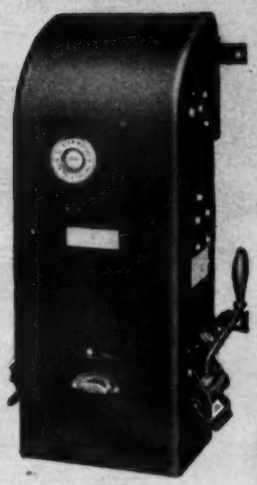
★ ATTRACTIVE IN APPEARANCE

★ DESIGNED TO BLEND WITH MODERN MACHINES

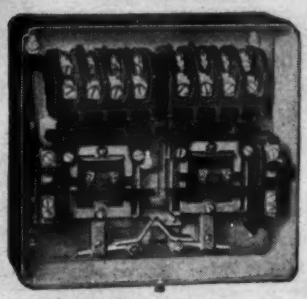
Motor-starting Switch—Recommended for full-voltage starting of small motors. Manually operated. Operating mechanism trips free on overload, making it impossible to hold switch closed under injurious conditions.



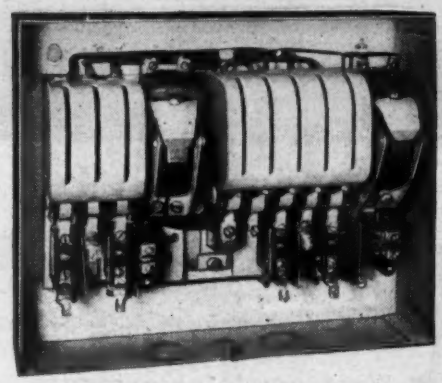
A-c Magnetic Starter—Can be used as a full-voltage starter of squirrel-cage motors, or as a primary switch for wound-rotor induction motors. Provides dependable operation, safety to the operator and to the machines.



A-c Magnetic Reversing Switch—Especially for use on machine-tool or similar applications where it is necessary to run the motor in forward and reverse directions. Provides full-voltage starting and overload protection in both directions of operation.



Reduced-voltage Starter—A manual, autotransformer-type starter for squirrel-cage induction motors. Undervoltage protection provides safety for the operator and the driven machine.



A-c Multispeed Magnetic Starter—A full-voltage starter for two-, three-, or four-speed squirrel-cage motors. Provides dependable operation where motors are started frequently, and where remote control is desired—on pumps, blowers, ventilating fans, and machine-tool applications.

INDUSTRIAL CONTROL

WHAT IS YOUR APPLICATION?

G-E starters come in a variety of enclosures to meet any operating conditions in your plant. We'd like to send you any additional information you may want. And remember, our engineers will be glad to help you select the correct type of starter for your needs. *General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

676-134-8920

This boy tried hard—but he lost.

He was searching for something. In his simple way, he believed he'd find it in the prize fight game. But he didn't seem to have the Big Plan thought out, or something. He lost.

It's that way with people, with organizations, with nations. To survive, we've got to do a lot of thinking. This is a time for it—individually and collectively.

Because this is the Second World War. A Third might reduce all of us, our hopes, our essential rightness, to a pile of ashes. This is a time for straight thinking.

We at Bryant have been trying to see things straight. Some time ago we realized that as essential suppliers to industry we had better have a pretty solid plan. A plan based upon search and research—upon a knowledge of new and better methods of building the needed things of peace—upon service to all comers who might use our specialized knowledge to build a better America. That seemed a good plan, and it has been.

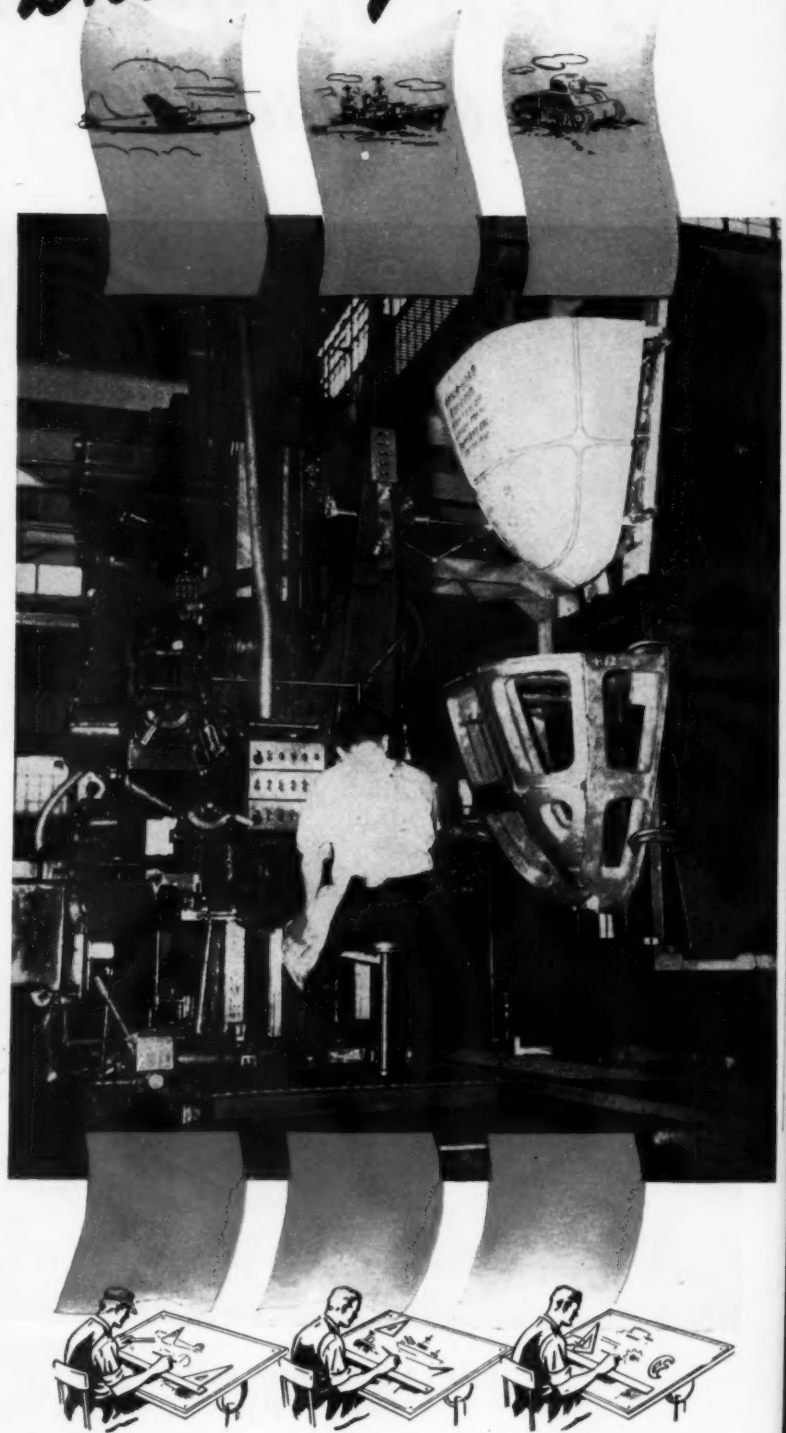
For today, our engineers are working with the engineers, designers and planners of scores of successful American businesses, and many new ones, large and small—helping them to plan now, conversion of their plants, skills and machines to all-out production of new and better products for a prosperous peace.

If you are a manufacturer, we invite you to call us in today.

BRYANT CHUCKING GRINDER COMPANY SPRINGFIELD VERMONT, U.S.A.

Up from the Drawing Boards

The P&W Keller is proving invaluable in turning out parts and pilot models for new and vital war equipment.



Bigger, more powerful airplanes, new inventions, changes in design, advanced models . . . all of these are flowing daily from America's drawing boards into experimental models and actual production lines.

Bridging the gap in thousands of instances is the Pratt & Whitney Keller machine . . . the "machine with a brain" which transforms wooden or plaster models into finished steel experimental parts with speed, economy, and accuracy.

The Keller can make up any shaped part within a range of 2.5′ x 6′ x 12′ out of a plain slab of steel or Duralumin or similar metals. It can work in two or three dimensions. It side-steps costly tooling, expensive dies. Most important, it hastens the arrival on the fighting fronts of new and vital equipment which can help shorten the war.

Built with the precision for which Pratt & Whitney is famous, the Keller has an inherent long life and dependability. And it is equally at home turning out the products of peace . . . no conversion one way or the other. Full particulars on the scope and versatility of the Keller will be mailed upon request.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1 • CONNECTICUT

POST-WAR PRODUCTION
will demand Precision Machining

Manufacturing costs must be kept within reason if you are to meet the keen competition that is sure to come with the post-war period. Then, if ever, you will need shop machinery that will operate with unquestionable precision. There will be no margin for loss of time, labor, and material resulting from the use of inaccurate, obsolete machines.

South Bend Lathes are designed and built to provide the extreme accuracy required for efficient production. Throughout the war they have been performing hundreds of essential war production operations with toolroom precision. Their war-time record stands as a recommendation worthy of careful consideration when peace-time plans are made. Substantial savings in capital investment, power consumption, floor space, and labor costs often result from their selection.

Today South Bend Lathes are better in every way. All of our facilities are still devoted to their manufacture. Improvements have been accelerated to meet war production needs. Their smooth, vibration-free operation at high speed permits finish turning and boring with such precision that subsequent grinding, honing, or lapping operations can often be eliminated.

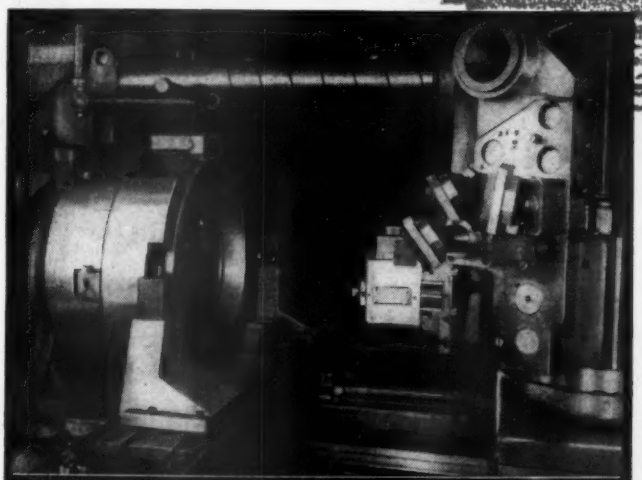
Numerous attachments are available which simplify tooling South Bend Lathes for many special and unusual classes of precision work.

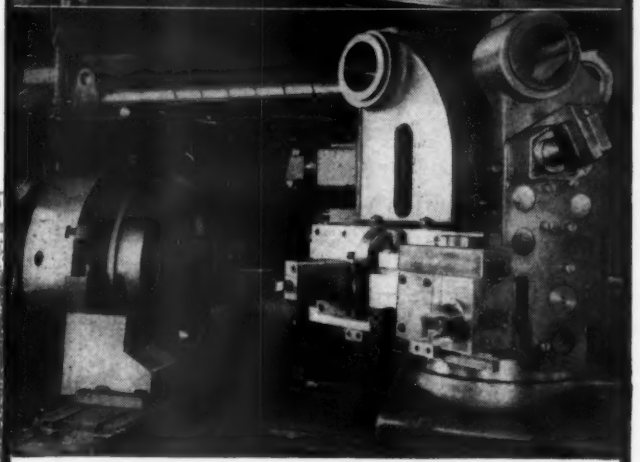
NEW CATALOG NOW READY
Write For It!

Illustrated in full color — showing all types and sizes of South Bend Lathes. Engine Lathes and Toolroom Lathes with 9″, 10″, 13″, 14½″, and 16″ swing. Precision Turret Lathes with ½″ and 1″ collet capacity. Ask for Catalog No. 100-D.

SOUTH BEND LATHE WORKS
LATHE BUILDERS FOR 38 YEARS
419 E. MADISON STREET SOUTH BEND 22, INDIANA

Include P&J RE-TOOLING IN YOUR PLANS FOR RECONVERSION.....





Production men recognize the importance of being able to consummate their post-war plans quickly in spite of the fact that many new machine tools may not be available when they are most urgently needed.

One answer to this problem of reconversion lies in ability to change over present equipment quickly to handle work other than that for which the original tooling was designed. The tooling set-up on the 8 DXT P & J Automatic for example, for machining flywheels, can be readily changed to make this machine a valuable cost-cutter in the production of other parts.

Owners of P & J Chucking Equipment are, therefore, in an advantageous position because, with P & J machines, re-tooling is practical and profitable and can be worked out in advance of immediate requirements with full assurance that the manufactured parts will be produced at lowest cost.

You are urged to consult with P & J engineers now on your post-war plans and thereby simplify your reconversion problems.

P&J REBUILDING SERVICE

Owners of P & J Equipment should investigate P & J shop facilities for restoring present machines to original accuracy and productivity through rebuilding. A convenient time for re-tooling is available when machines are in our shop for rebuilding.

POTTER & JOHNSTON MACHINE CO.

PAWTUCKET, R. I.

THE EXTRA BONDS YOU BUY ARE THE ONES THAT COUNT

You Can Do a Wide Range of Work With This Wade MOTOR DRIVEN BENCH PROFILER

FOR SMALL PROFILING, MILLING, SLOTTING, RECESSING AND ROUTING OPERATIONS

SPECIFICATIONS

Working area:
2" x 4" horizontal, 1¼" vertical
Fixture block: 4" x 4" x ½"
Work surface of table: 4¼" x 4"
Travel of vertical slide: 1¼"
Travel of table: 4½"
Travel of cross slide: 2"
Cutting tool collet: Any standard size up to 5/16" dia. Standard ¼" collet supplied unless otherwise specified.
Distance of table to nose of spindle, when down: 2¾"
Center distance, cutter spindle to follower: Approx. 2-1/16"
Follower cutter spindle: No. 2 B&S taper
Motor: Standard ¼ h.p., 3-phase
Speeds: Four speeds ranging from 1000 to 8000 RPM
Dimensions: 19" wide, 24" long, 22" high.
Weight: Net, 260 lbs., boxed, 285 lbs.

You can do a wide range of precision work with this Wade Motor Driven Bench Profiler . . . work such as profiling, milling, slotting, recessing and routing operations . . . on a variety of small parts such as watch and clock plates, clock mechanisms, mechanical time fuses, parts for small firearms, range finder parts, typewriter and adding machine parts, etc.

It is a precision built profiler for production work. Women and unskilled help can quickly become expert in its operation and turn out duplicate precision work within exceedingly close tolerances.

The Wade Bench Profiler is a time and money saver . . . a small, moderately priced machine tool that will pay for itself over and over in your production line.

Write today for catalog

Wade

Bench Lathes and Profilers For Precision, Versatility And Stamina

THE WADE TOOL COMPANY

WALTHAM 54, MASSACHUSETTS

THE MOST IMPORTANT MODERN GEAR DEVELOPMENT IS THE

Elliptoid Tooth Form

The Elliptoid (crowned) gear tooth form eliminates the most important cause for gear tooth failure—"end bearing". When the gear tooth load is carried away from the ends of the tooth consistently, its full strength may be relied on. But when the load is concentrated on either end of the tooth, that gear is vulnerable.

The difference in tooth thickness between center and ends need be very little (.0003" to .0005" per inch of face), but when that difference is consistent, the gear develops maximum strength.

Red Ring Rotary Shaving Machines provide the means to give gear teeth Elliptoid Form, in addition to correcting errors in tooth spacing, helical angle, tooth profile, eccentricity and undesirable roughness.

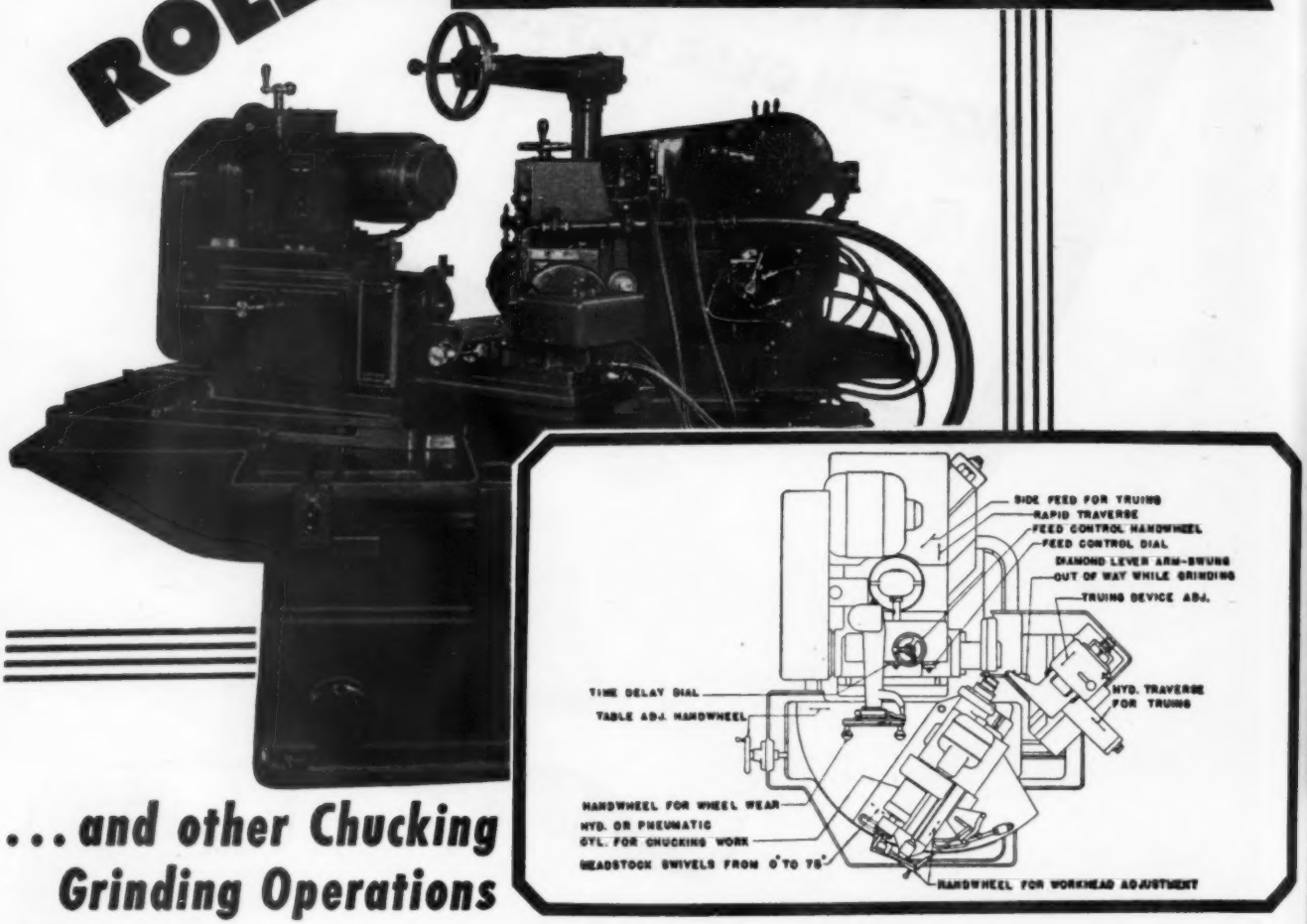
NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICH.

SPECIALISTS IN SPUR AND HELICAL INVOLUTE GEAR PRACTICE
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

RED RING PRODUCTS

GRIND ROLLER BEARING RACES ON A FITCHBURG


SIDE FEED FOR TRUING
RAPID TRAVERSE
FEED CONTROL HANDWHEEL
FEED CONTROL DIAL
DIAMOND LEVER ARM—SWUNG OUT OF WAY WHILE GRINDING
TRUING DEVICE ADJ.
TIME DELAY DIAL
TABLE ADJ. HANDWHEEL
HYD. TRAVERSE FOR TRUING
HANDWHEEL FOR WHEEL WEAR
HYD. OR PNEUMATIC CYL. FOR CHUCKING WORK
HEADSTOCK SWIVELS FROM 0° TO 75°
HANDWHEEL FOR WORKHEAD ADJUSTMENT

. . . and other Chucking Grinding Operations

THE latest Fitchburg Roller Bearing Race Grinder employs a single standard Fitchburg Bowgage Grinding Wheelhead Unit. The workhead is adjustable from o degrees to 75 degrees so that the machine can be used for many other straight or taper grinding jobs.

The Fitchburg Roller Bearing Race Grinder is completely automatic. By pressing a single button the wheelhead goes through its standard automatic cycle — rapid traverse to the work, proper grinding feed, spark-out time, and rapid return. Work is held to limits of .0002" in production.

The workhead can be arranged either hydraulically or pneumatically for collet clamping or other chucking devices.

In this taper grinding application, the wheelhead is mounted on a 45° slide for trueing. The trueing device is mounted on the side of the base parallel to the wheelhead, and is hydraulically operated for trueing, with micrometer adjustment for positioning.

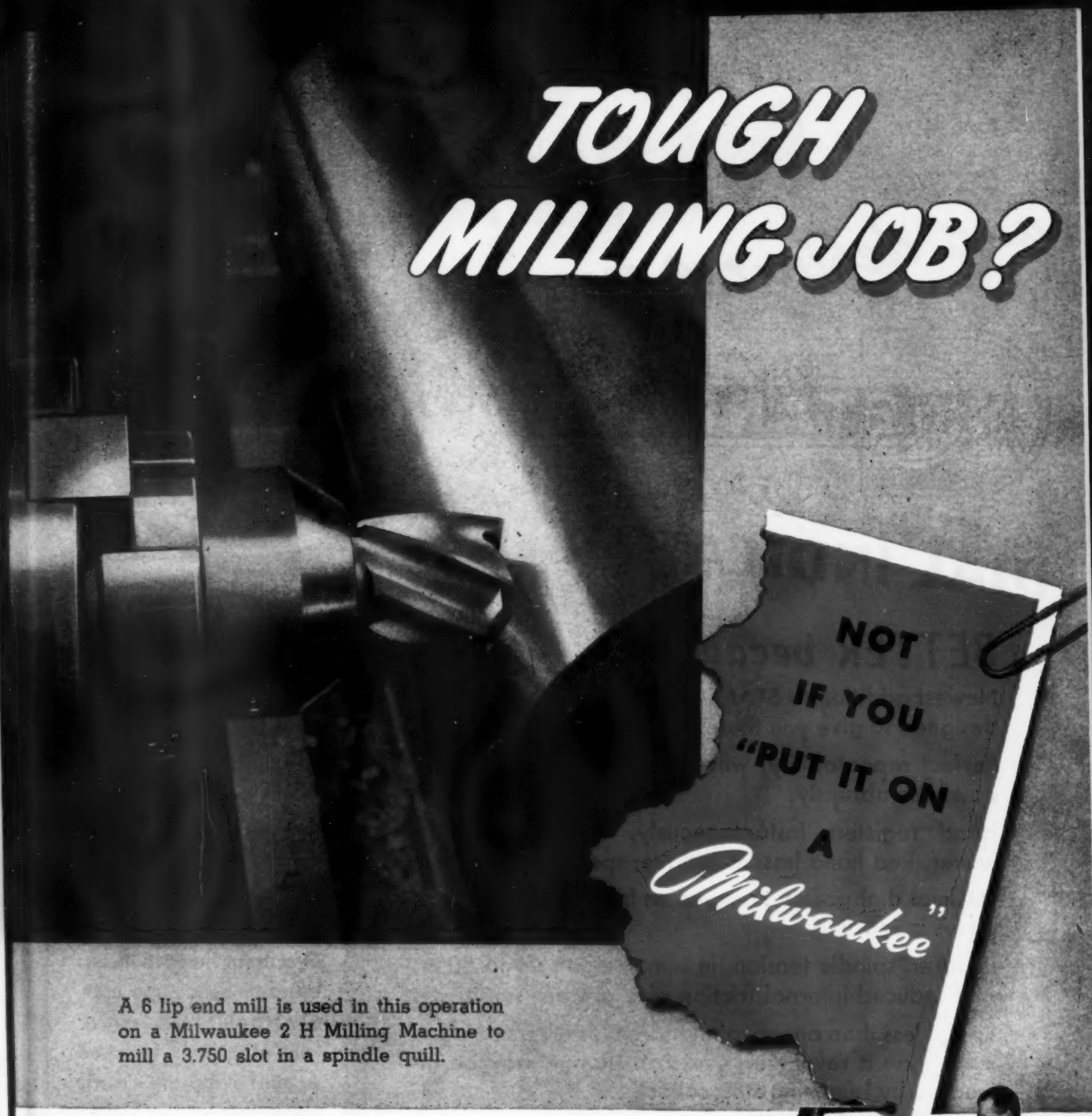
For grinding roller bearing races a Fitchburg grinds them faster and more accurately than other methods. A leading American manufacturer reports enthusiastically on the quality and low production cost of this machine. Write us today for complete information.

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U.S.A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Both Full Universal Grinders and Special Purpose Grinders

TOUGH MILLING JOB?

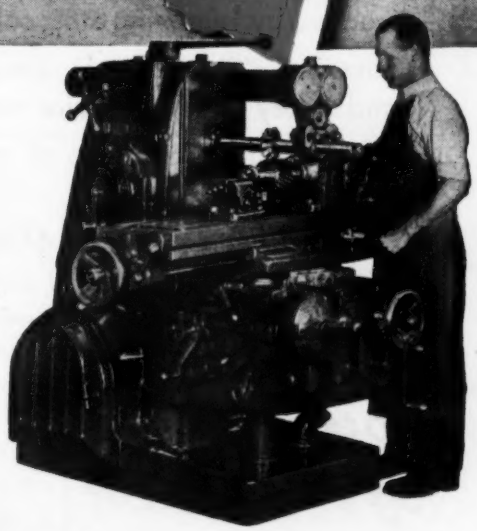


NOT IF YOU "PUT IT ON A Milwaukee"

A 6 lip end mill is used in this operation on a Milwaukee 2 H Milling Machine to mill a 3.750 slot in a spindle quill.

The range—power—precision of Milwaukee Milling Machines —their exceptional ability to handle a wide variety of intricate, difficult milling operations at the most effective speeds and feeds — has made them the first choice of experienced purchasers. "Put it on a Milwaukee" and you know the job will be done *right* — and with the least time and trouble.

Year after year you can be sure of sustained precision performance because every Milwaukee Milling Machine—is engineered and built in proper relation to its motor power — powerated!



Milwaukee Machine Tools

KEARNEY & TRECKER CORPORATION

MILWAUKEE 14, WISCONSIN

NEW!
and definitely BETTER

STANDARD
Decimatic
DIAL INDICATOR

★ *BETTER because:*

Newest addition to STANDARD line, purposely designed to give you these gaging advantages:

★ Perfect repeatability, whether workpiece is applied slowly or abruptly.

★ Hand registers instantaneously, without whip or waver. Red hand lessens fatigue; speeds inspection.

★ Decimal dial graduations, as on blue print, eliminate errors in reading.

★ Reduced spindle tension, in some models up to 50%, and reduced internal friction give greater sensitivity.

★ Range less than one revolution. Avoids errors on parts more than a revolution oversize. (Range may be increased by removing stop collar).

★ Patented "Shockproof" design protects mechanism and is key to the *superior* accuracy of this Indicator.

★ Upper half of face free of excess markings to facilitate easy reading.

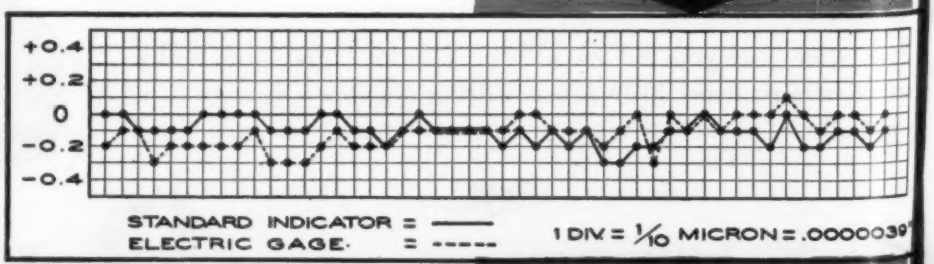
★ All mounting dimensions AGD standards.

Ask for Special Decimatic Bulletin

Catches Rejections Red-Handed

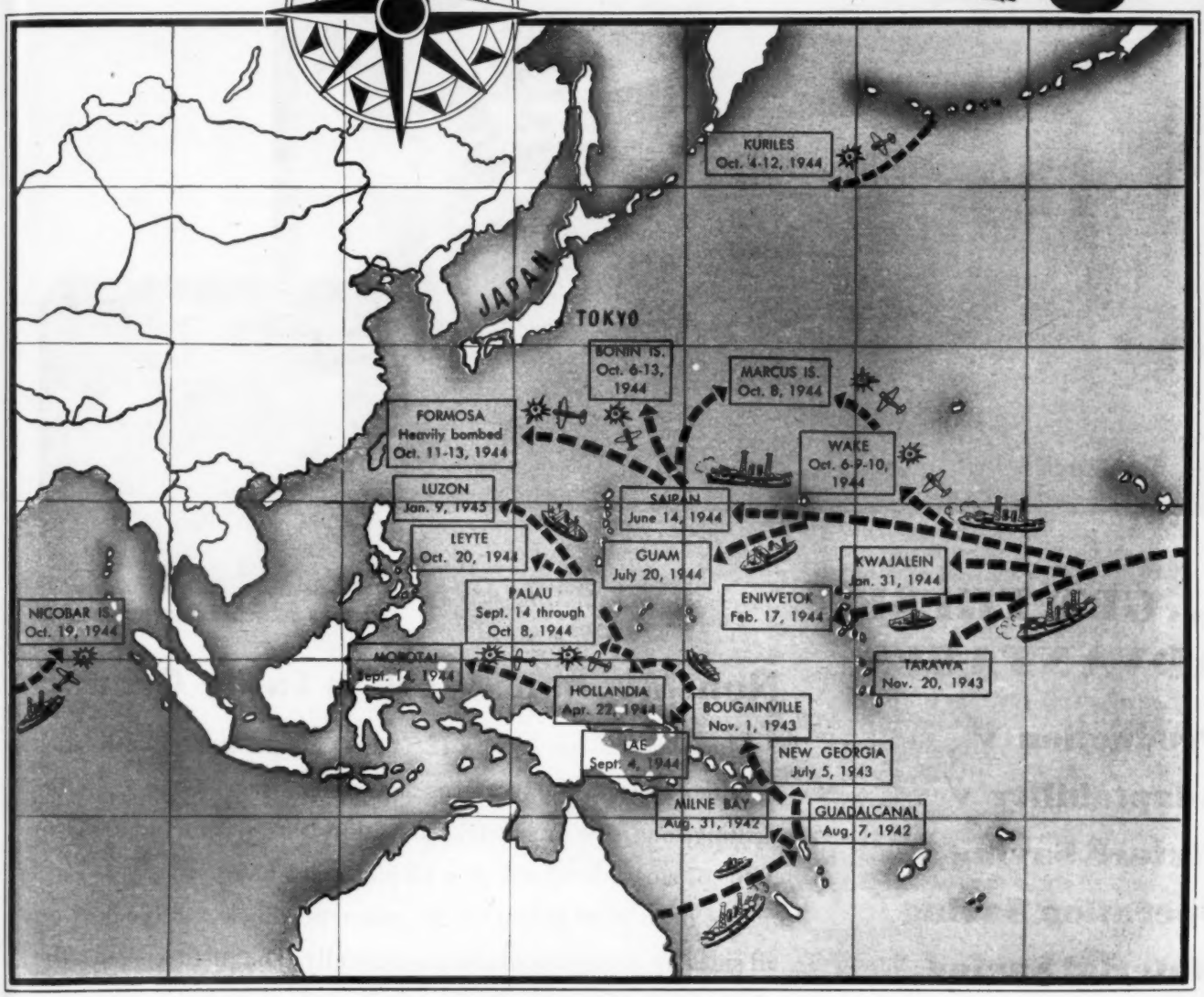
Graph of impartial test by prominent gage user. STANDARD *Decimatic* repeatability checked against elaborate electric gage costing more than ten times as much. Note greatest difference in readings does not exceed 2/10 micron.

A Convincing Comparison of Precision



STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

HIGHWAY TO TOKYO



KEEP THAT GUARD UP!

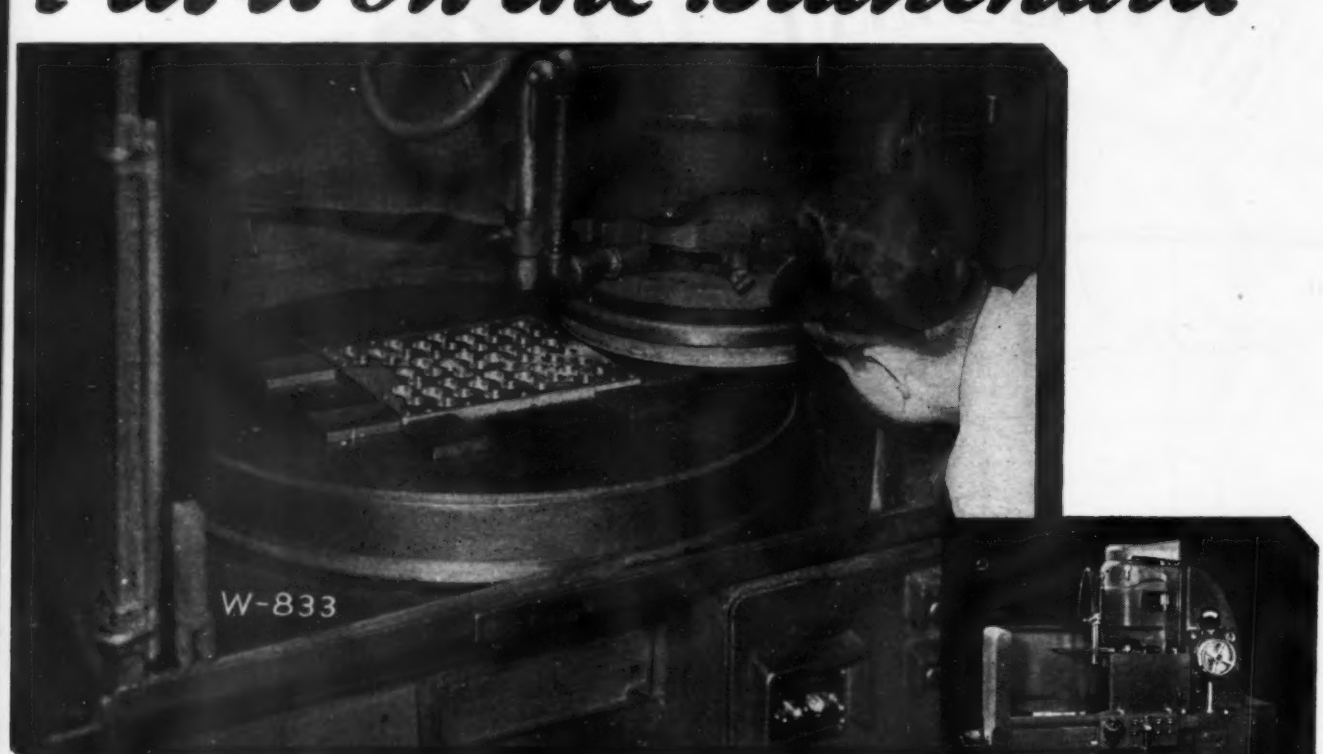
PRODUCERS OF HAMILTON STEAM AND DIESEL ENGINES, CANNON AND MACHINE TOOLS

GENERAL MACHINERY CORPORATION

HAMILTON, OHIO

THE NILES TOOL WORKS CO. • THE HOOVEN, OWENS, RENTSCHLER CO. • GENERAL MACHINERY ORDNANCE CORPORATION

"Put it on the Blanchard"



No. 18 BLANCHARD SURFACE GRINDER

...GET THESE ADVANTAGES

Production ✓
Adaptability ✓
Fixture Saving ✓
Operation Saving
Material Saving
Fine Finish
Flatness ✓
Close Limits

Non-Magnetic Work is Easily Ground

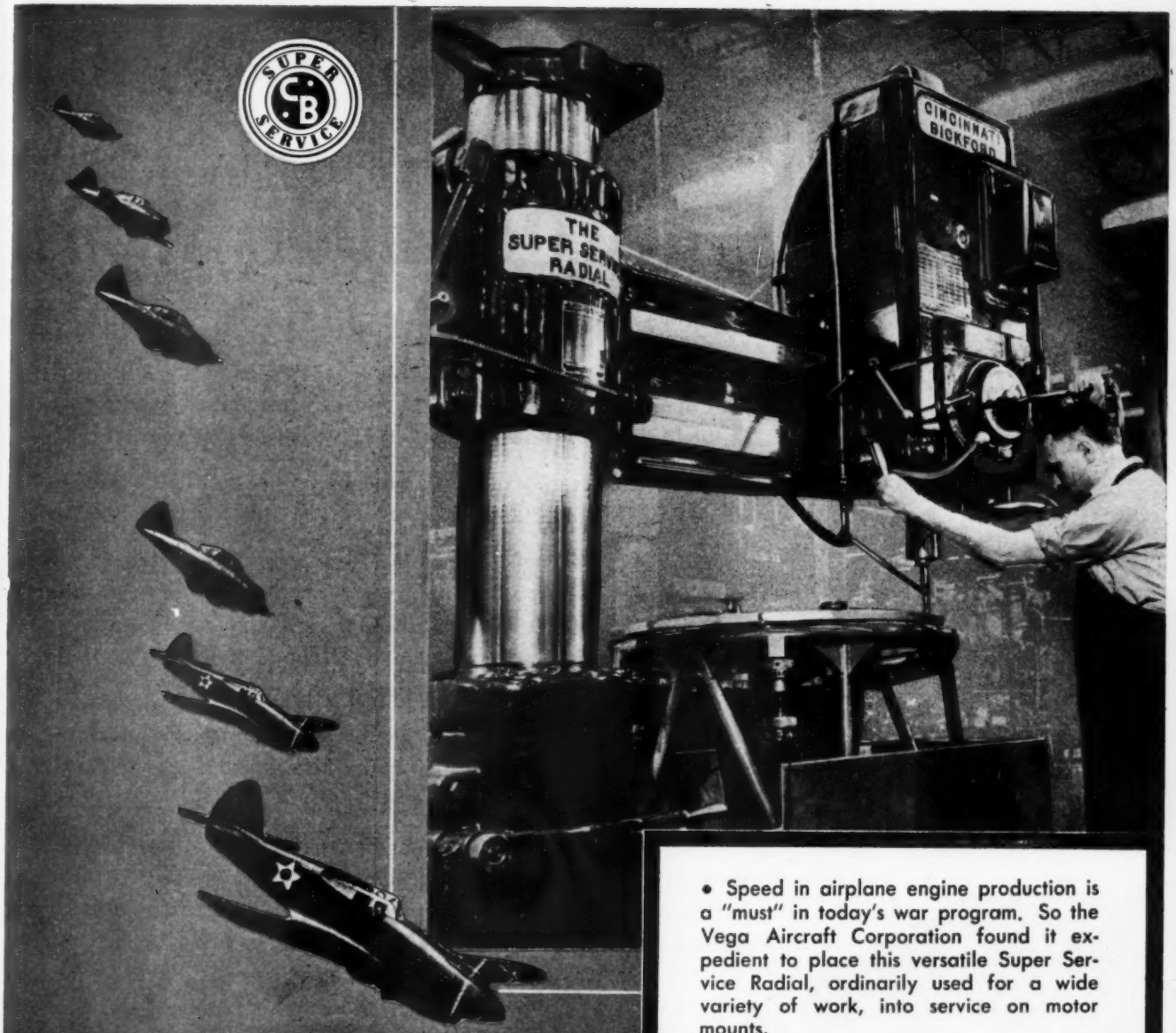
These brass plates 14½" x 12⅝" x ¾" are ground on both sides to almost clean the surfaces before holes are drilled. After drilling, one side is ground flat within .003" removing .005" to .006" of stock. Production is 15 plates per hour.

The brass plate is laid on the magnetic chuck and blocked on all sides by steel pieces held magnetically. The picture shows the plate as chucked for finish grinding. In rough grinding the same setup is used with shims under the work, if needed, to prevent rocking.

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

The BLANCHARD MACHINE COMPANY
64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.



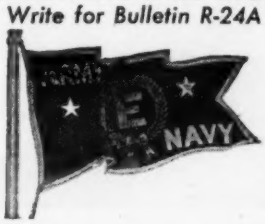
MOTOR MOUNTS
FOR VEGA AIRCRAFT drilled and reamed accurately in quantity lots . . . *with a* SUPER SERVICE RADIAL

• Speed in airplane engine production is a "must" in today's war program. So the Vega Aircraft Corporation found it expedient to place this versatile Super Service Radial, ordinarily used for a wide variety of work, into service on motor mounts.

Here we see the machine busy on this work. The motor mount is a ring about 3½' in diameter. Six holes are drilled and reamed 15/16" through a 2" boss and also spot faced and countersunk on both sides. A tolerance of .0015" is easily held. Time is approximately three hours per piece.

One of the reasons why this machine has proved so serviceable on the work assigned to it lies in the fact that 18 rates of feed and 36 useful speeds are instantly available to operate cutting tools at maximum efficiency.

You'll be interested in the whole story. Write for Bulletin R-24A



The CINCINNATI BICKFORD TOOL COMPANY

OAKLEY, CINCINNATI 9 OHIO, U. S. A.

They work a 168 hour week

IN many war plants, Warner & Swasey turret lathes are in ceaseless operation—24 hours a day—7 days a week—without let-up.

Warner & Swasey stamina stands out under continuous operating schedules.

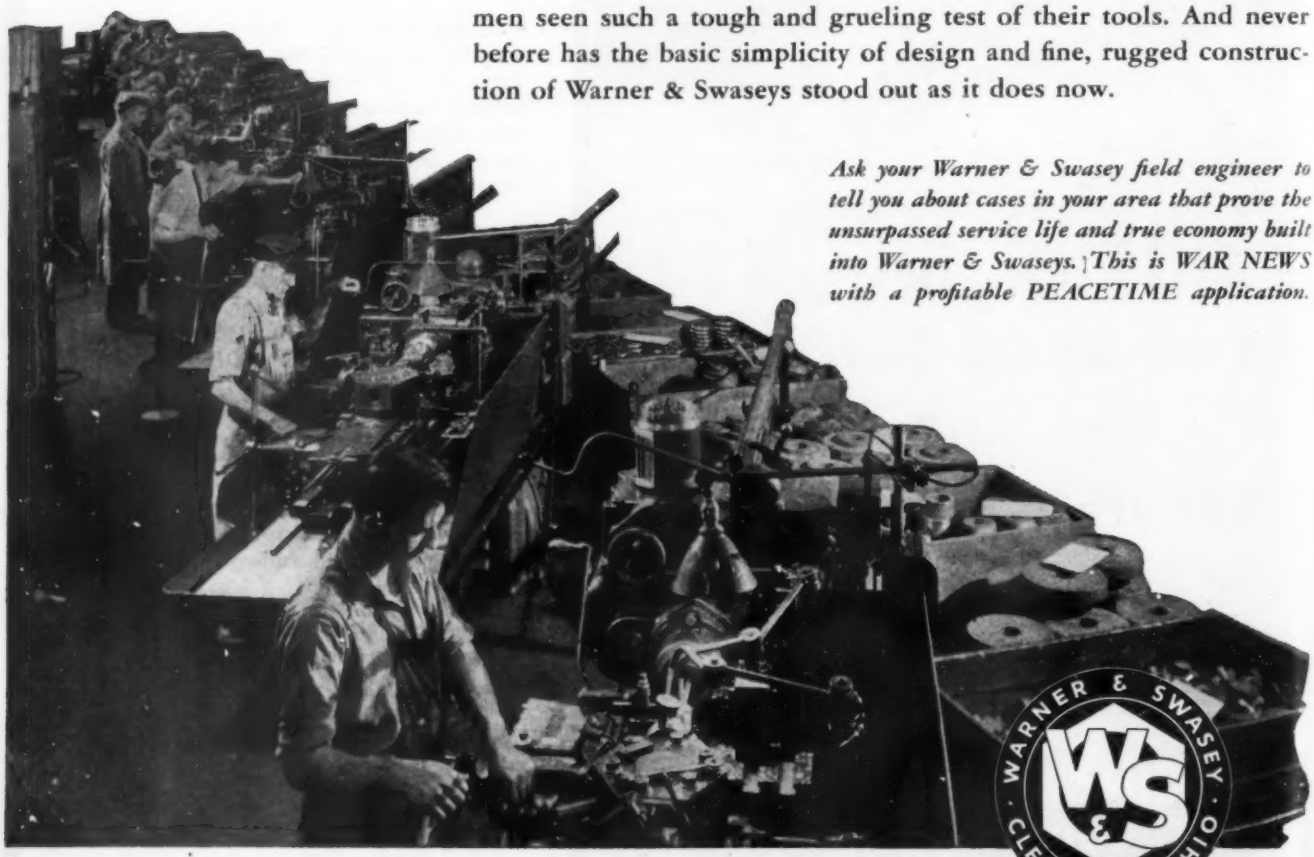
One specific example is in the New Jersey plant of a great Electric Company, where a battery of Warner & Swaseys has been running continuously since 1942 with the only maintenance being an occasional clutch adjustment. A recent check up shows these turret lathes to be in excellent condition—ready to keep up the pace.

Under the heavy demands of war production schedules, Warner & Swaseys have duplicated this round-the-clock, seven days a week, performance in plant after plant.

Never before in modern manufacturing history have production men seen such a tough and grueling test of their tools. And never before has the basic simplicity of design and fine, rugged construction of Warner & Swaseys stood out as it does now.

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY

Ask your Warner & Swasey field engineer to tell you about cases in your area that prove the unsurpassed service life and true economy built into Warner & Swaseys. This is WAR NEWS with a profitable PEACETIME application.



TURRET LATHES, SADDLE AND RAM TYPES—CHUCKING AND BAR TOOLS—TAPPING AND THREADING MACHINES

"Pre-Determination"

"PRE-DETERMINATION" is a new word that war contractors should add to their vocabulary.

It has to do with speedy settlements of war contracts by agreeing in advance upon a workable formula subscribed to by the contractor and the government.

Instead of waiting until a contract runs out or until the government suddenly serves notice of cancellation, the two parties arrive at an understanding ahead of time.

The understanding involves such vital matters as the disposition of parts and materials, overhead costs, percentage of cost to be charged for administration, profit percentage, the propriety of items of post-termination expense, and agreement to the percentage of partial payment by the government on claims after termination.

Pre-determination is not confined to prime contractors. It should be extended to subcontractors, particularly to "first-tier" subcontractors.

The chief value of pre-determination is the making of decisions on contract termination *now* in an orderly and leisurely fashion rather than later when decisions must of necessity be made hastily and under high pressure.

If contract termination agreements are put off until after the war, or until an avalanche of them descends without warning, inevitable delays will handicap contractors in converting their plants to peacetime products. Postponement by an extra month or more may easily occur between war and civilian production, an undesirable situation from a competitive or an employment angle.

Studebaker is the originator of pre-determination. In addition to its own pre-termination agreements (as pre-determination is known), Studebaker has urged its 400 biggest subcontractors to organize in similar fashion.

Here is an inkling of the result. Some twenty-five decisions are involved in making a pre-determination agreement with each Studebaker subcontractor. That means 10,000 separate decisions to get matters straightened out with 400 subcontractors.

About one thousand informal written pre-termination agreements have been completed between contractors and the War Department, and hundreds more are in process. Thirty-five formal agreements have been sealed, and close to four hundred are being negotiated.

War contractors' first and foremost thoughts and efforts must be directed toward winning the war. Nothing should interfere with that purpose.

That does not signify, however, that we should neglect all preparations for what must be done when and if the war should end quickly, especially if those preparations can be made without cutting down by one pound the production of war goods.

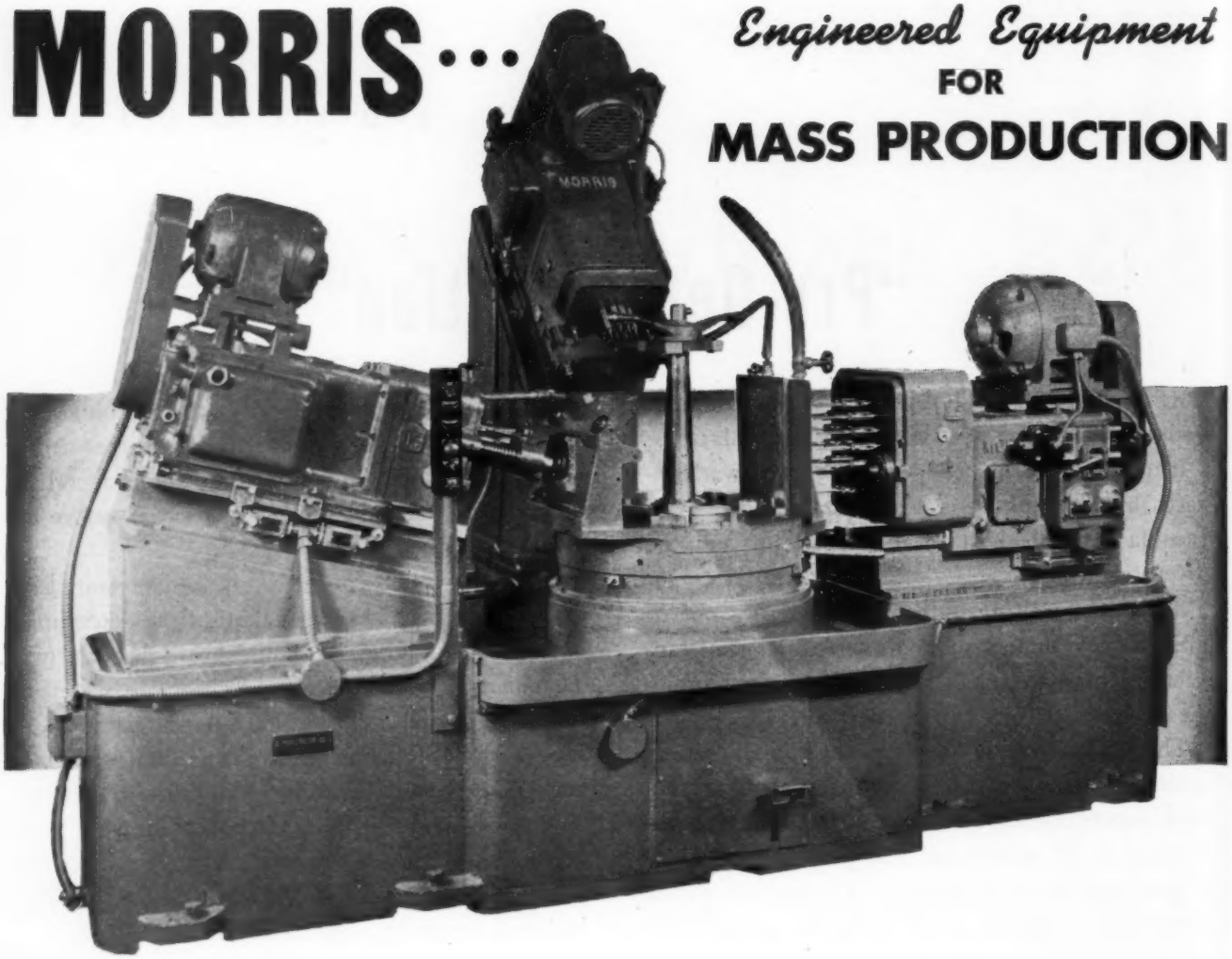
Pre-determination has the blessing of the War Department. If you are a war contractor, you should take advantage of it. You can't possibly lose and stand to gain a lot.

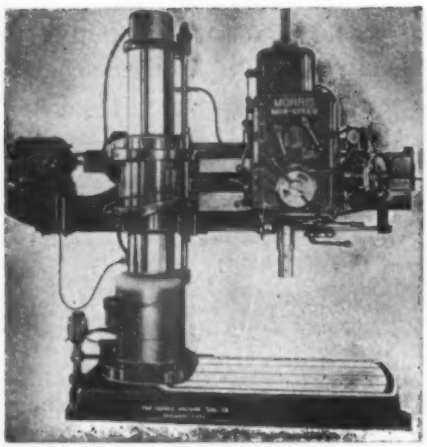
If enough war contractors adopt pre-determination as a policy, it will ease and speed inestimably the transition from war to peace. Let's not forget that 130,000,000 people hope that the reconversion period will be as short as possible.

Burnham Finney

MORRIS...

Engineered Equipment
FOR
MASS PRODUCTION





MORRIS MOR-SPEED RADIAL

● This unique machine was developed by Morris for drilling and reaming aircraft engine parts quickly—easily—in large quantities.

It has 24 spindles for drilling and reaming operations and an indexing table which permits work to be turned for machining holes at different angles in the same plane.

The work holding fixture is controlled by hand clamp. The standard hydraulic head units operate automatically with push button control.

If you are interested in high production equipment for drilling—reaming—tapping and similar operations consult Morris. They have the engineers—the organization—the facilities and the experience to help you in developing special high production equipment.

Builders of MOR-SPEED Radials

The MORRIS Machine Tool Co.
CINCINNATI 3, OHIO

Properties of Stainless Steels Affect Welding Methods

BY W. J. CONLEY, CONSULTING ENGINEER, THE LINCOLN ELECTRIC COMPANY

UNDER THE INFLUENCE of wartime emergencies an almost unlimited field of new applications for stainless steels has opened up. Stainless-clad tanks, valve fittings, synthetic-rubber processing containers, heat exchangers, aircraft exhausts, forging dies and piping installations are some of the items. Rapid advancements in fabricating techniques, electrodes, and equipment have made welding an outstanding process in the construction of all types of stainless steel articles.

When chromium and nickel are restored for peacetime production, stainless alloys, because of their ability to withstand the attacks of corrosion and oxidation, will be specified for scores of household items and for commercial products such as trucks, buses, and railway cars.

The resistance of most stainless steels to fatigue, impact, and wear, and their ability to retain these properties even under subnormal temperatures will influence their use for assemblies in vehicles and structures that will be used under sub-Arctic conditions. The impact resistance of 18-8 stainless steel, for example, is practically the same at — 100 F. as at + 70 F.

In order to become familiar with the stainless steels, it is important to understand the physical properties of the various groups of stainless steel alloys, each of which has

its individual composition. There are a host of different types in the 18-8 and 25-12 classifications put out by various companies under different trade names.

In looking over the analyses in the tables, it will be noted that in general they can be divided into two classes: chrome-nickel alloys (austenitic) and straight-chrome alloys (ferritic).

The chrome-nickel types, contain approximately 17 percent or more chromium with 7 percent or more nickel, are soft and tough as welded, harden quite rapidly when cold-worked, are non-magnetic, and cannot be hardened by any form of heat-treatment. Quenching from 2,000 F. merely softens them and this treatment is used to put these steels in the best condition to resist corrosion.

The straight chrome types, contain 12 percent or more chromium with no nickel, are relatively brittle as welded, do not harden much with cold-working, and are magnetic.

18-8 Is Most Familiar

There are a variety of analyses under each of these classes, but a computation of the tonnages shows that the most commonly and most widely used is the so-called 18-8 variety—that is, having approximately 18 percent chromium and 8 percent nickel (types 301, 302, 302B, 303, and 304).

Perhaps the most important property of 18-8 is its resistance to corrosion. There has been no single metal found in nature, not even gold or platinum, which is unaffected by corrosive attack in all environments, and no alloy has been developed which remains unattacked in all solutions. The stainless iron types of alloys are clearly the cheapest alloys which offer ample resistance to attack under some of the commonest and most active conditions.

The industrial reagents which are incapable of attacking clean surfaces of low carbon fully annealed 18-8 under laboratory conditions would make up a long list, and no attempt will be made here to tabulate all of them. Some idea of the many applications for 18-8 stainless steel may be gained from the following examples of reagents to which such steels are resistant: acetic acid, cold, at any concentration; acetic acid, hot, up to approximately 10 percent; alkaline solutions in general, including ammonium hydroxide; bichloride of mercury, dilute (usual antiseptic strength); carbolic acid; carbonated water; nitric acid, cold, moderate strength; copper sulphate; fruit and vegetable juices; hydrogen peroxide; hydrogen sulphide; laundry solutions with a few exceptions; milk and dairy products; nitric acid; photographic solutions; salt solution; sea water; sulphuric acid, cold (very slight action); sulphurous acid; wood pulp; yeast; zinc chloride, cold; zinc sulphate.

It should also be mentioned that at ordinary natural temperatures the atmosphere — with its usual traces of corrosive gases and variable moisture—leaves no evidence of attack upon the surface of 18-8.

Several Variations of 18-8

As will be noted in the table of analyses, there are various modifications of the 18-8 alloy, each of which has certain advantages over the regular 18-8. For example, type No. 303 contains a relatively high percentage of sulphur or selenium which gives the alloy free machining properties. Type 302B, containing 2.00-3.00 percent silicon, is used for resistance to sealing up to 1,700 F. Type 316, containing 1.75-2.50 percent molybdenum has a higher creep strength than regular 18-8 and is more resistant to corrosion by hot sulphite liquors and bleaches encountered in the paper-pulp industry. Others, such as 308, 309, and 310 contain slightly higher percentages of chromium and nickel, preferred in some cases for special applications.

In order to resist corrosion to its fullest extent the regular 18-8 alloy must be in its austenitic or softest state, in which the carbon is present in solid solution. Unfortunately, this alloy is unstable under certain forms of heat-treatment. When heated in the range between 800 F. and 1,400 F. it undergoes a structural change which reduces the corrosion resistant properties and its ability to withstand strains. This condition is aggravated if the alloy is held to such temperatures for a long period of time.

One type of stainless steel is soft after welding, another is relatively brittle. These and other facts about the material are discussed in this first of two articles on the subject. Some of the new applications developed during the wartime emergency are also reviewed

How Corrosion Can Occur

The cause of this defect is thought to be precipitation at the grain boundaries of fine films of chromium-rich carbides, containing as much as 90 percent chromium taken from the layer of metal next to the grain boundary. Under these conditions the chromium content of the metal adjacent to the grain boundaries may be so reduced that its resistance to corrosion will be seriously impaired. This is generally spoken of as carbide precipitation and the type of corrosion which is then likely to occur is known as intergranular corrosion.

The conditions necessary to produce this change are easily realized during welding—that is, heating between 800 F. and 1,400 F. This, however, is less true of arc welding than other welding processes because the heat of metallic arc welding is instantaneous and can be applied exactly where it is needed. The welder has close control of the arc and can easily direct and localize it at the point of fusion. Furthermore, he can vary the current to obtain welding heat of the exact amount needed for proper fusion.

Various methods of reducing or preventing intergranular corrosion have been devised. Heating the welded article to 1,850 to 2,100 F. and rapidly cooling by quenching causes a solution of the precipitated carbides. This treatment may cause distortion of finished parts and may be impossible for large welded structures.

One remedy is to reduce the carbon content of the alloy to such a low value that no carbide can be precipitated. It has been found that 18-8 with a carbon content of 0.02 percent is free from the danger of intergranular corrosion. However, the cost of production of such an alloy is high and it is not commercially available. The 18-8 type with 0.08 percent carbon maximum is usually specified for welded structures and an electrode which contains 0.05 to 0.07 percent carbon is used in order to minimize carbon precipitation.

Another development is the addi-

Left—The interior of a welded fractionating tower built of 18-8 stainless steel. The ribs are welded to the shell with a continuous bead

Below—A stainless steel propeller and shaft for a chemical agitator are welded together. The propeller is fitted on the shaft and then tack welded in place

tion of an alloying element which has a greater affinity for carbon than has chromium. Types 320 and 321 are such alloys, titanium being the stabilizing element. Such alloys are widely used for welded members. Though susceptibility to intergranular corrosion in areas adjacent to the weld can be effectively prevented by the use of these types, addition of titanium to welding electrodes has not been entirely successful as most of it is lost during welding. Type 347 has columbium as a stabilizing element. Since columbium is equally as effective and is not lost in the welding operation, freedom from intergranular corrosion in the weld metal is possible by the use of an electrode which contains this element in suitable proportions.

With another group of alloys known as 25-12 the same general remarks are applicable. These are used for heat resistance up to very high temperatures, such as might be found in chemical plants, heaters, and refinery equipment. They resist scaling to a greater degree than 18-8 alloys.

Creep Strength Improved

Alloys other than 18-8 and 25-12 are coming into more extensive use. One of these is type 316, 18-8 mo. This type has greater resistance to certain types of corrosion than the regular 18-8. The addition of molybdenum has been particularly advantageous where the corrosive agent tends to be of a reducing nature. This alloy has increased resistance to sulphuric, sulphurous, hydrochloric, acetic, phosphoric, formic, citric, tartoric, and other acids and has been quite successful in handling such acids as sulphite pulp liquor in paper and pulp mill equipment, bleaching solutions, and coal or oil smoke.

Physical characteristics of this alloy are similar to the 18-8 type but the creep strength is improved, thus making its use in high temperature applications advantageous. No heat-treatment is usually required after welding. Molybdenum is thought to act as a partial stabilizing agent in reducing the carbide precipitate. It is not, however, a complete stabilizer, but does assist in reducing the effect of corrosive attacks.

There are too many additional alloys to discuss completely; however, the so-called 25-20, or type 310, is used quite extensively. This is used where high strength and greatest oxidation resistance are wanted at highest temperatures.

An electrode of this type (310) has been used during the war to weld alloy steels of the armor-plate type.

Stainless-clad steel is a ply material having a thin surface of true stainless steel, usually about 20 percent of the total thickness, on a foundation of soft or mild steel. It was developed to provide the corrosion-resisting advantages of solid stainless steel at a reduced cost.

It is evident that if a sheet or plate has a thin surface of the relatively costly stainless steel, the bulk of the sheet or plate being ordinary steel, the cost of the stainless-clad product will be lower than if it were made up entirely of solid stainless steel. On this basis stainless-clad steel has found acceptance for many applications where the corrosion resistance of stainless steel is desired, but where the economy of the clad steel dictated its use.

Three typical stainless-clad steel analyses include regular 18-8 low-carbon type 304; 18-8 columbium-bearing type 347; 18-8 molybdenum-bearing type 316. Other analyses are also supplied.

The columbium-stabilized type 347 is used for applications where equipment must operate in the presence of elevated temperatures in combination with corrosion conditions. It is also desirable for parts that must be heated for forming in the process of fabrication.

The selection of the type or analysis to be used must be given careful consideration inasmuch as the performance of equipment depends upon it directly.

The physical properties of stainless-clad steel are a combination of the physical properties of the two metals—mild steel and stainless steel—which form the combined sheet or plate.

Straight Chromium Steels

Steels containing 4 to 6 percent chromium are not stainless steel although frequently classified as such. They are finding increasing use in the form of furnace tubing, cracking stills, hot oil transfer lines, heat exchangers, bubble tower caps, return bends, valves, and in the form of plates for fabrication.

Physical properties of the 4-6

chromium alloys develop some interesting possibilities. In the first place, this steel can be soft annealed to physical properties similar to those of mild carbon steels, and therefore it is suitable for equipment where severe cold work is applied during fabrication. It is obvious that many articles, so shaped that quenching in liquid media is difficult, might be produced from steels containing 4 to 6 percent chromium, and subsequently heat-treated, without excessive distortion, to the desired properties.

The most noticeable property of the 4-6 chromium steels is their intense air hardening which is proportional to both the carbon and chromium contents. This factor must be considered in all operations involving the use of these materials where reheating occurs, such as welding, hot bending, forging. After such operations, the metal should be annealed by heating to 1,575 F. and cooling slowly in the furnace, or reheating to 1,400 F. for several hours depending upon the thickness of the section. The fully annealed material can be bent, flanged, and expanded cold almost as readily as low carbon steel.

Keep Carbon Content Low

Carbon very noticeably affects the various physical qualities of this group of steels. It should be kept in mind that for welded construction, carbon content of the welded material should be low, certainly under 10 percent.

The 4-6 chromium steels are types 501 and 502. Type 501 has a carbon content over 0.10 and type 502 has a maximum carbon content of 0.10 percent.

In the air-hardened condition and in the fully annealed condition, the elastic ratio for these alloys is low, often being less than 50 percent, whereas the air hardened and tempered material shows high elastic ratios, usually over 80 percent.

The carbon content has an appreciable effect on the yield point and tensile strength, especially on the soft annealed material. In applications where this alloy is to be used for high temperature service, such as cracking-still tubes and condenser tubes, and where flanging, rolling, and other manipulations are required, only soft annealed material should be employed. Exposure of semi-annealed material for long periods at temperatures between 800 and 1,200 F. gradually produces the effect of a soft anneal.

The previous discussion refers chiefly to the 4-6 chromium alloy groups without other alloy additions. The addition of alloys such as molybdenum, tungsten, and titanium, produce satisfactory results and are used in many cases where the qualities which these alloys give to this group are desirable.

Probably the most commonly used additional alloy is molybdenum, usually in an amount of approximately 0.5 percent. This addition of molybdenum does not appreciably affect the physical qualities of the steels at room temperatures after the different heat-treatments, but it does increase to a considerable degree the strength of these steels at elevated temperatures and, according to some tests, increases the resistance to certain types of corrosion. There is also an increase in creep strength.

One percent tungsten has somewhat the same effect but increases the tensile strength at room temperature. Tungsten, being a relatively scarce alloy, usually increases the cost.

A summary of the principal characteristics of straight chromium-steel alloys as compared with ordinary carbon steel reveals that their coefficients of expansion under heat are about the same or slightly less than plain steel; their heat conductivity is less, thus they hold heat longer; their resistance to electricity varies from three to six times that of ordinary steel; and they require less heat for melting and are much more fluid in the melted state.

ANALYSIS OF STAINLESS STEEL

Type No.	Carbon percent	Chromium percent	Nickel percent	Manganese percent Max.	Silicon percent Max.	Phosphorus Max. percent	Sulphur Max. percent	Other Elements percent
*301	0.08–0.20	16.00–18.00	6.00– 8.00	2.00	1.00	0.04	0.04	——
*302	0.08–0.20	17.00–19.00	8.00–10.00	2.00	1.00	0.04	0.04	——
*302B	0.08–0.20	17.00–19.00	8.00–10.00	2.00	2.00–3.00	0.04	0.04	——
*303	0.20 max.	17.00–19.00	8.00–10.00	2.00	1.00	——	——	P or S or Se Min. 0.07 Zr or Mo Max. 0.60
x304	0.08 max.	18.00–20.00	8.00–10.00	2.00	1.00	0.04	0.04	——
x308	0.08 max.	19.00–21.00	10.00–12.00	2.00	1.00	0.04	0.04	——
309	0.20 max.	22.00–24.00	12.00–15.00	2.00	1.00	0.04	0.04	——
310	0.25 max.	24.00–26.00	19.00–22.00	2.00	1.50	0.04	0.04	——
x316	0.10 max.	16.00–18.00	10.00–14.00	2.00	1.00	0.04	0.04	Mo 1.75–2.50
321	0.10 max.	17.00–19.00	8.00–11.00	2.00	1.00	0.04	0.04	Ti 4 x C Min.
347	0.10 max.	17.00–19.00	9.00–12.00	2.00	1.00	0.04	0.04	Cb 8 x C Min.

*No specific composition limits within the above range should be placed on Types 301, 302, 302B and 303 except that carbon may be specified to a 4-point range within the above limits.
xIn these types manufacturers may accept specifications and furnish material with a guaranteed carbon content of .08 maximum.

Issued by the American Iron and Steel Institute, New York.

ANALYSIS OF CHROME STEEL

Type No.	Carbon percent	Chromium percent	Nickel percent	Manganese percent Max.	Silicon percent Max.	Phosphorus Max. percent	Sulphur Max. percent	Other Elements percent
403	0.15 max.	11.50–13.00	——	1.00	1.00	0.04	0.04	Turbine Quality
405	0.08 max.	11.50–13.50	——	1.00	1.00	0.04	0.04	Al 0.10–0.30
406	0.15 max.	12.00–14.00	——	1.00	1.00	0.04	0.04	Al 3.50–4.50
410	0.15 max.	11.50–13.50	——	1.00	1.00	0.04	0.04	——
414	0.15 max.	11.50–13.50	1.25– 2.50	1.00	1.00	0.04	0.04	——
416	0.15 max.	12.00–14.00	——	1.00	1.00	——	——	P or S or Se Min. 0.07 Zr or Mo Max. 0.60
420	Over 0.15	12.00–14.00	——	1.00	1.00	0.04	0.04	——
430	0.12 max.	14.00–18.00	——	1.00	1.00	0.04	0.04	——
430F	0.12 max.	14.00–18.00	——	1.00	1.00	——	——	P or S or Se Min. 0.07 Zr or Mo Max. 0.60
431	0.20 max.	15.00–17.00	1.25– 2.50	1.00	1.00	0.04	0.04	——
440A	0.60–0.75	16.00–18.00	——	1.00	1.00	0.04	0.04	——
440B	0.75–0.95	16.00–18.00	——	1.00	1.00	0.04	0.04	——
440C	0.95–1.20	16.00–18.00	——	1.00	1.00	0.04	0.04	——
442	0.35 max.	18.00–23.00	——	1.00	1.00	0.04	0.04	——
443	0.20 max.	18.00–23.00	——	1.00	1.00	0.04	0.04	0.90–1.25 Cu
446	0.35 max.	23.00–27.00	——	1.00	1.00	0.04	0.04	——
501	Over 0.10	4.00– 6.00	——	1.00	1.00	0.04	0.04	——
502	0.10 max.	4.00– 6.00	——	1.00	1.00	0.04	0.04	——

Issued by the American Iron and Steel Institute, New York.

Columbus Manufacturers Cooperate In Preparing for Termination

Formed to speed complete and exact information to members, a termination association has enlightened manufacturers and aided in intelligent planning

REMINISCENT of communal activities of various types is the truly American plan Columbus, Ohio, manufacturers adopted in preparing to meet termination problems.

The presence of several small manufacturers in the area seemed to dictate joint action. Representatives assembled and formed the Columbus Termination Association.

For many of these companies, the settlement of claims will constitute their only source of income during the reconversion period. Obviously, a company that waited too long to organize for termination and reconversion—or which failed to prepare properly—might well find itself lost in the shuffle.

By way of disseminating information, semi-monthly dinner meetings are held. Authoritative speakers discuss phases of termination and renegotiation. The talks are followed by open forum discussions of the problems association members anticipate or are experiencing. It has been found that, through this exchange of experience and information, the answers to most termination problems can be readily obtained. The information offered by members to other members in establishing termination staffs and practices has proved invaluable, say association officers.

Military Officers Speak

Since members of the association have contracts with all branches of the armed services, programs are arranged to draw speakers from each of these branches.

Readjustment officers of the Army and of the Navy are stationed in Columbus and they are members of the association by invitation. This common membership in a group working toward a mutual goal is considered advantageous to both the contracting agencies and the manufacturers. A feeling of mutual understanding of the problems they both face is engendered, while the mere fact of getting acquainted before the actual "fireworks" start is of considerable importance. A feeling of confidence and mutual trust promoted by these dinner meetings is expected to go a long way toward expediting the settlement of claims.

Covers Broad Field

The association consists of member companies whose products include shell cases, component airplane parts, airplanes, binoculars, guns, landing barges, tanks and precision instruments. The wide variance in size of the companies may be judged by the divergences in manpower totals from a minimum of 100 to a maximum of 24,000. Principal amounts of the contracts vary from $120,000 to $100,000,000.

It is generally believed by association officers that a deplorable emphasis was placed earlier on the difficulties of settling a cancelled war contract. The dinner meetings have gone far to dispel this feeling and to bring readjustment out into the open as a perfectly normal business procedure.

Those belonging to the association have been aided by "Prior Termination Planning," a manual which details procedures, from initial step to final settlement. It is typical of the spirit of the association that this manual was prepared by Ranco, Inc., one of the members, and has been made available, without cost, to all association members.

Says S. T. Rose, secretary-treasurer of the association, in summing up its work, "The planning and positive action of business leaders individually and in groups will be a decisive factor in the transition period. It is these qualities that will determine the success of our return to peacetime economy."

Los Angeles Holds Postwar Clinic

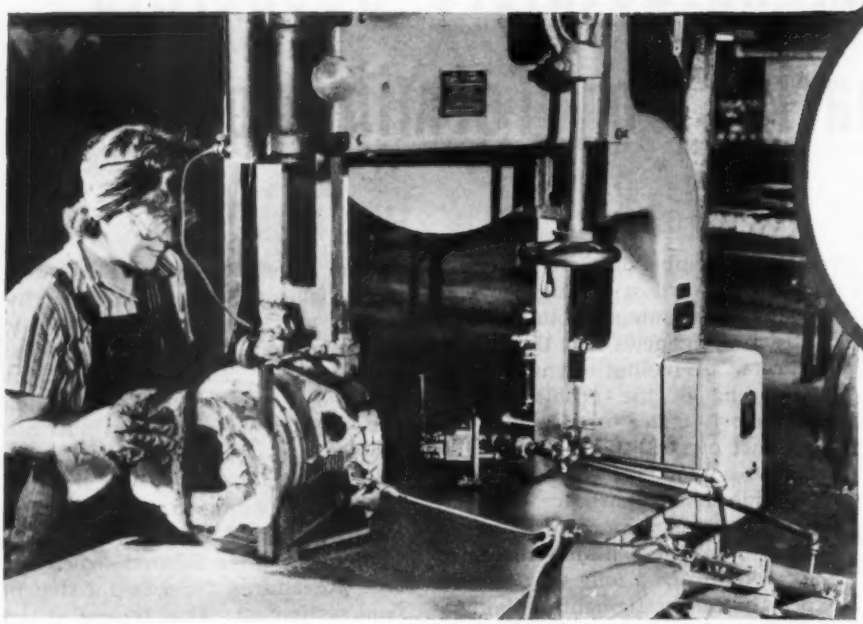
ADVICE is being given to Los Angeles manufacturers on the design and marketing of postwar products by a "clinic" recently inaugurated by the Domestic Trade section of the local Chamber of Commerce.

A panel of "experts" meets weekly, and a manufacturer is allowed one-half hour in which to pose his problem and get the advice and assistance of the wholesaler, retailer, advertising man, resident buyer, and the designer who make up the panel.

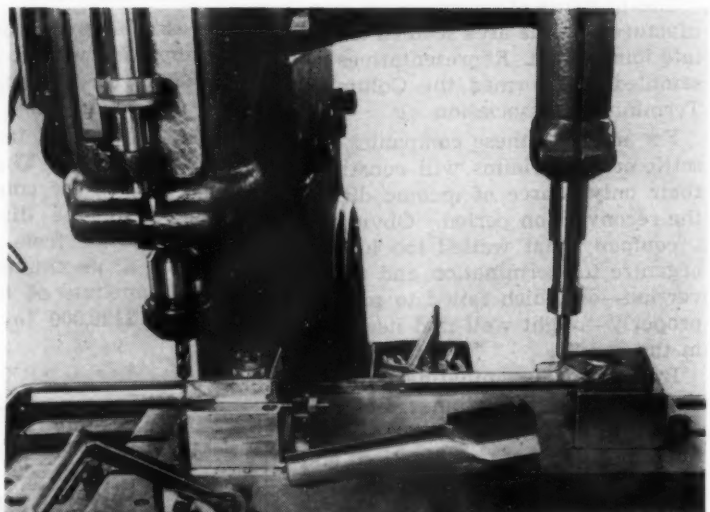
The sessions are "off the record" so that manufacturers may feel free to display models and plans for new products, and so that the experts may render opinions on such marketing problems as price, mark-ups, channels of distribution, advertising, and the design of products for greater consumer appeal.

There are many smaller local manufacturing plants who are entirely unfamiliar with the problems of marketing the products that they expect to manufacture after the war, and many of them are availing themselves of the opportunity to get the advice of the Chamber of Commerce experts.

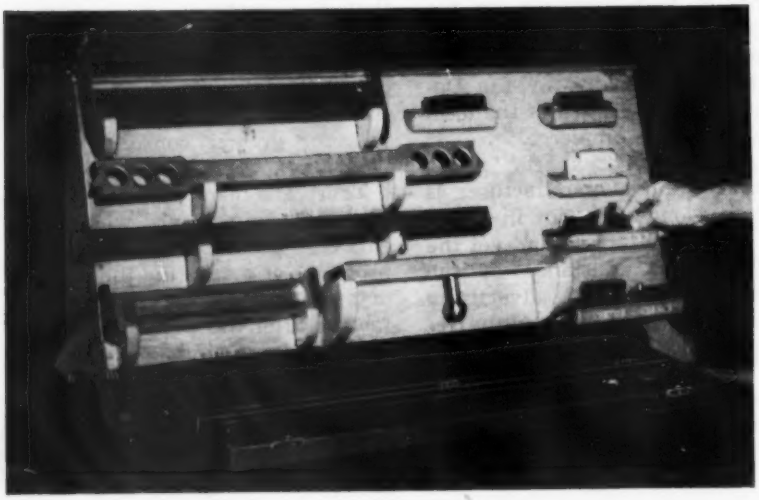
SHOP SHOTS



Sawing excess metal from aircraft-type cylinder heads in an aluminum foundry has been made easier by mounting a power feed unit on the table of a metal-cutting bandsaw. The cylinder head casting is placed on a cradle connected by steel cable to the piston of a double-acting pneumatic cylinder below the table surface. An air valve bolted to a bracket on the saw table controls the feed cylinder. Shut-off valves in each line, connecting the cylinder with its control valve, govern the feed when the valve is operated. *Caterpillar Tractor Company.*

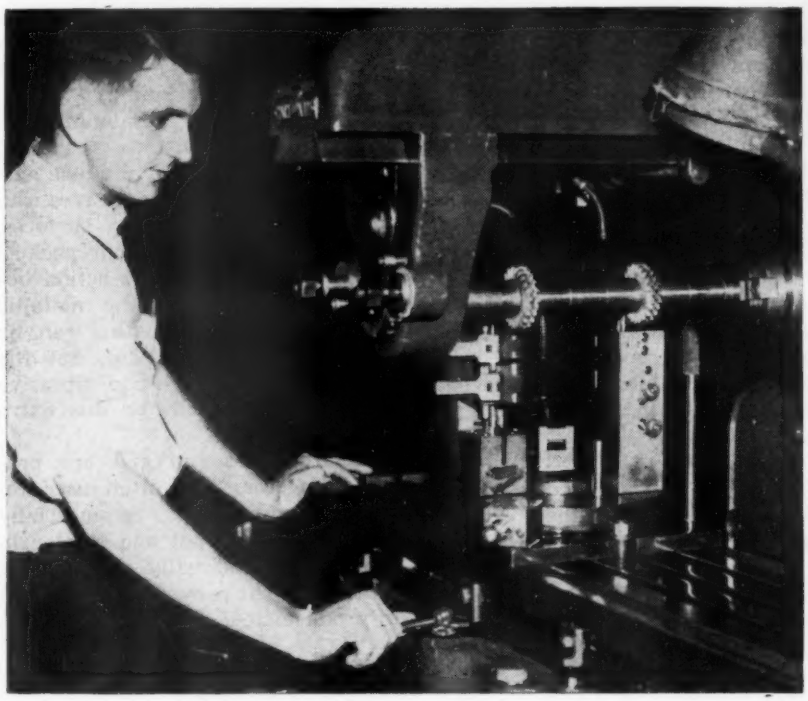


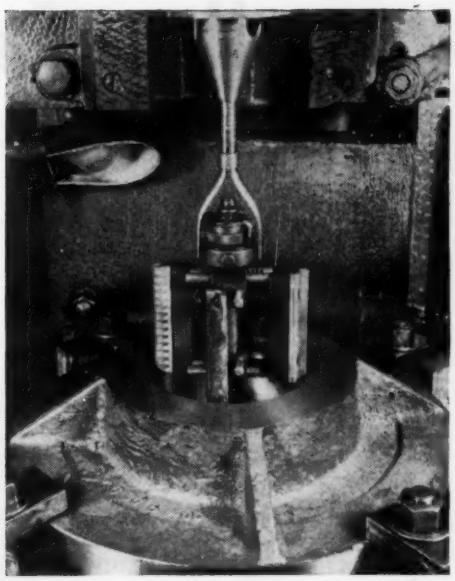
Gage boards set on a bench near each of the production machines minimize damage to gages and insure that each operator has the required gages conveniently at hand. These gages are checked at regular intervals to insure continued accuracy. *Nash - Kelvinator Corporation.*



Fillets in marine steam turbine blades are now finished with a ⅝-in helical end mill at a saving of 125 man-hours per blade ring over the former method of hand grinding. A fixture for use on a Gorton duplicator consists of a base plate with two locating nests, one to hold the master form and the other for chucking the workpiece with a cam-action clamp. To make the master a babbit impression was made from a carefully finished blade, and a wooden pattern made from the babbit was sent to the iron foundry for casting. The polished casting was flame-hardened. A man can turn out 86 contoured blades in an eight-hour day except for final polishing; previously seven blades constituted a day's work. *Adolph Meyer, Joshua Hendy Iron Works.*

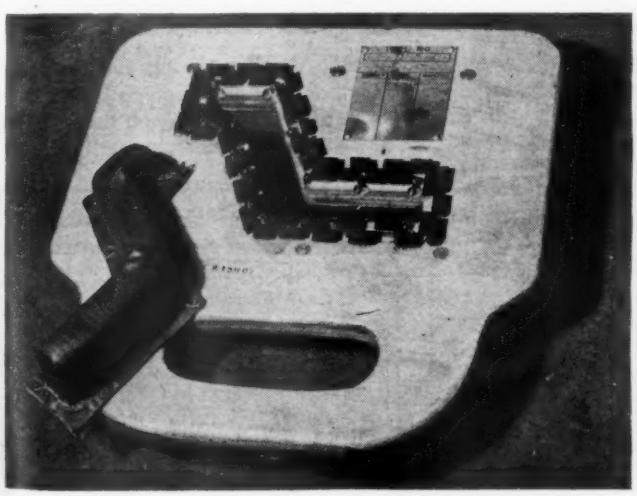
An index straddle mill fixture permits the flats on small shafts to be rough and finish machined in one operation. An index plate mounted on a base is used for positioning. Two upright arms equipped with cam-type clamps provide a means of holding the work. Operation is started by placing a shaft in the roughing position and running it through the roughing cutters. Then the fixture is indexed by the simple operation of pulling a locking pin and giving the fixture a half turn. This puts the shaft in position for the finish cut, and another shaft is mounted in the roughing position. *O. E. Mantei, General Electric Company.*

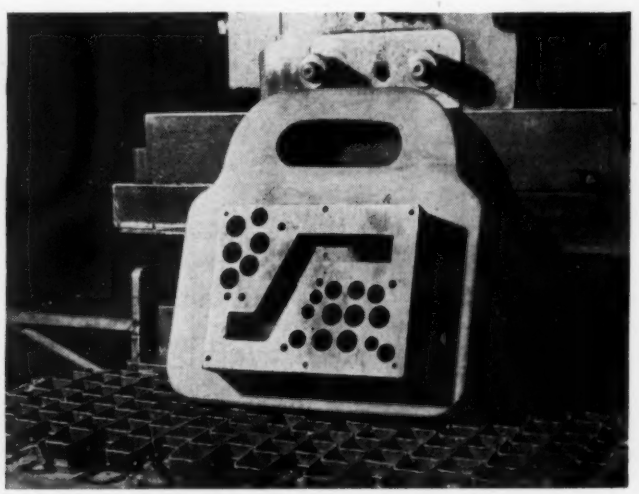




Honing the bore of a large cast steel spider for a Cone-Drive right-angle reduction gear while the part still is set up in a Bullard vertical turret lathe makes it possible to hold the bore diameter of approximately 5.500 in. within tolerances of plus 0.0005 in. minus 0 while producing a surface finish in the bore of ten micro-inches or better. A standard Sunnen adjustable cylinder hone head is used with four stones of approximately 80 grit. Lengths of the bore is about 8 in., and ten minutes are required to remove 0.0010 to 0.0015 in. of stock. Kerosene is used as a coolant during the honing operation. *E. Palmquist, superintendent, Cone Drive Division, Michigan Tool Company.*

Uniformly cut flexible parts are now trimmed in rule dies adaptable to punch press operation. The die blade, made of laminated hardwood, has an opening to receive the material. The opening is bordered by a rule fitted into slots in the die blade. (See illustration of die and a pad that has just been trimmed.) Hollow punches are placed between the rule and the opening to pierce attachment holes in the pad flange. A back-up block (see below), which allows for the depth of the pad, is attached to the under side of the die blade. The upper half of the die is a hardened "kissing" plate; between it and the die is a "make-ready" of sheet paper, laminated in a patchwork pattern to compensate for irregularities in the surface of the rule die and to insure proper contact with it. Correct pressure is predetermined by set-up blocks made to the exact dimensions of the die plate, rule die and back-up block. *Charles Hodges, Consolidated-Vultee Aircraft Corp.*





Many Factors Govern Selection Of

BY D. C. TURNBULL, CHIEF ENGINEER, AMERICAN FOUNDRY EQUIPMENT COMPANY

Whether to use sand, steel shot or grit depends upon material to be cleaned, equipment used and type of finish to be attained

THE ABRASIVE used for a blast-cleaning operation is an important factor in determining the time of cleaning and the resultant finish on blasted surfaces, cost of the cleaning operation, storage space required and handling facilities needed. Abrasives generally used for blast-cleaning operations are: (1) Metallic grit; (2) metallic shot; (3) aluminum oxide; (4) flint or silica sand; (5) bank or ocean sand; (6) carbides; and (7) steel chips, brass turnings and nail whiskers.

Cost Considerations

Bank sand is probably the most available blast-cleaning abrasive and has the lowest cost per ton, in many localities. This abrasive has largely been supplanted by flint sand, metallic shot and grit, or oxides for high production work, but for occasional jobs where the abrasive is used only once it may be most economical. Its principal disadvantages are: (1) It splits and scatters on impact, resulting in dust, waste of abrasive and waste of air; (2) silica dust remains on the metal to the detriment of further finishing, and creates a health hazard (silicosis); and (3) the quantity required creates additional cost for handling and storage.

Flint sand is higher in initial cost, because of work required to prepare it for use. Flint sand granules are rounded and wear down by spalling; they do not break up as rapidly as bank sand. They clean metal surfaces by a peening action. The usual size of a flint sand grain is 1/50 in. diameter, and passes through a 20-mesh screen, but is retained by a 40-mesh screen. Flint sand is more widely used for production work than bank sand. It causes silica dust but to a lesser degree than bank sand, and is bulky for handling and storage.

A sand-producing company lists the chief functions of flint sand when used for blast cleaning as follows:

1. Preparing forgings for cleaning, enameling and plating.
2. Preparing sheet metal and stampings for permanent finishes.
3. Removing grit or furnace scale from hot-rolled stock.
4. Removing grit or furnace scale from heat-treated parts.
5. Replacing tumbling as a means of cleaning and polishing metal parts.
6. Giving a matte finish to high-speed steel tools and similar work.
7. Cleaning, polishing and finishing operations on brass, bronze, aluminum and other non-ferrous metals.

A survey shows that on cast and malleable iron, metallic shot produced surfaces more deeply peened than did flint sand. On aluminum, brass and bronze the flint sand produced a smoother texture than the metallic grit, and produced a lighter color. On sheet steel there was no appreciable difference between flint sand and metallic grit, but it was found that both burned the steel plate when applied at too high a pressure.

The artificial abrasive, as contrasted to natural and metallic abrasives, generally used for blast cleaning is aluminum oxide. Aluminum oxide is used for such work because of its toughness and hardness. It does not break down to a soft powder, and continues to cut when reduced to fine particles. An important use of aluminum oxide is the preparation of magnesium alloy castings, prior to the application of corrosion-resistant coatings. Major producers of airplane engines use large quantities in sizes from No. 20 to 36. For this use, aluminum oxide is said to produce a type surface having superior adhesion qualities hereby assuring a more permanent coating. The resulting blast finish is a bright surface more like that produced by sand cleaning.

It is claimed that aluminum oxide generates less dust than sand and that the dust does not produce silicosis. Steel grit finishing leaves iron dust on magnesium alloy surfaces, which tends to produce air pockets and promote electrolytic action between the base and the metallic coating. The iron coating can be removed by an acid dip, but the use of aluminum oxide abrasive eliminates the need for this extra operation.

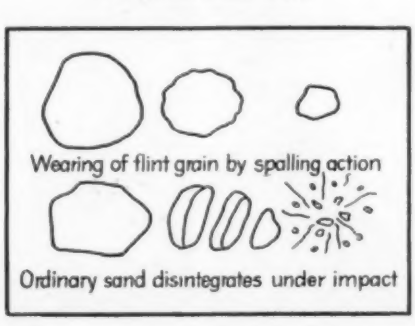
Metallic shot and grit are produced together and often used together. Although commercially known as steel shot and steel grit, this material is really chilled iron. Steel shot that is oversize is crushed to produce steel grit.

Metallic Shot Peens Surface

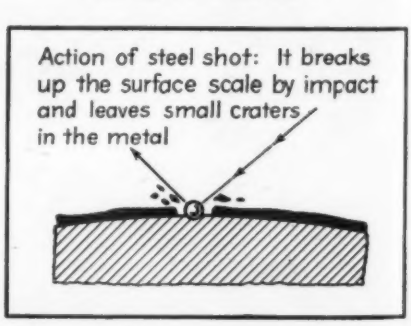
Since metallic shot is in the form of small balls, the effect of blast cleaning is a peening or pitting on the surfaces cleaned. Shot does not cut away surface steel, but breaks it up by impact. Size of indentations produced by the shot action varies in the size of shot, velocity and hardness of the surface hit.

Shot blasting has the effect of work-hardening metal surfaces, re-

Bank or ocean sand splits and scatters on impact, while flint sand granules wear down by spalling and are used for production work



Metallic shot breaks up surface scale by impact and the peening action produces a pitted effect upon the metallic lic surfaces cleaned



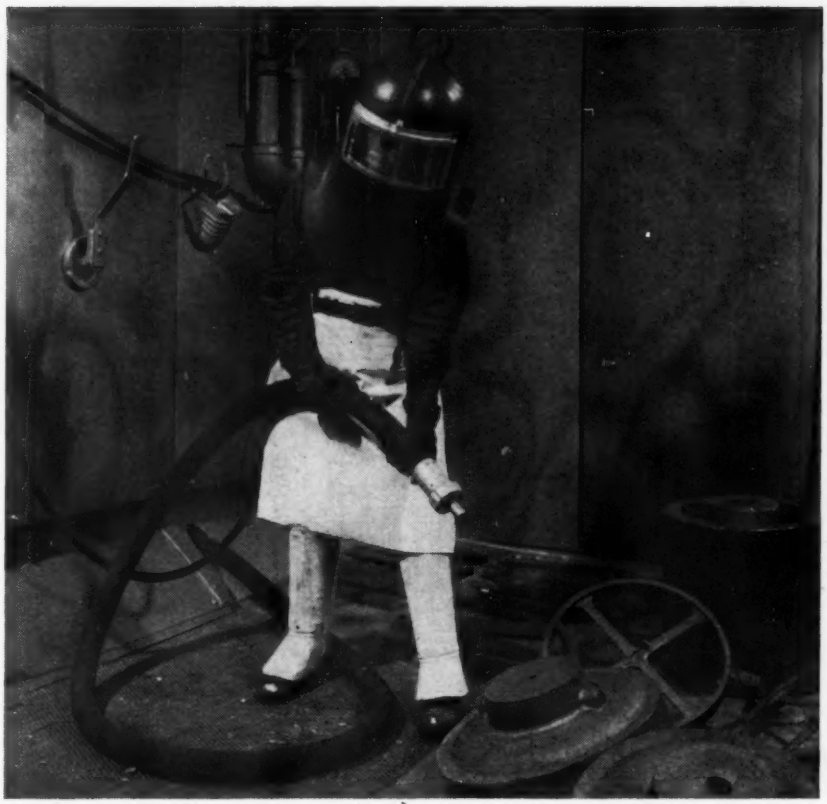
Abrasives for Blast Cleaning

lieving fatigue strains in the metal and providing tiny reservoirs which retain lubricants on the surfaces of sliding metal parts. It also stops cracks from spreading as the small individual craters appear to retard or prevent a crack from extending beyond two craters in length.

In general, shot blasting is adapted for work requiring impact or peening action rather than cutting action for removal of surface scale. The pitted surface is usually satisfactory on castings or other metal products that do not require subsequent finishing. Shot blasting may be found unsuitable for parts having thin web sections because of the high pressure exerted.

Since metal grit is angular in shape, its action may be compared to that of many small cutting edges. It opens surfaces blasted, showing surface defects that would be peened shut by the action of shot. Depending upon the size of grit used, the work surface varies from smooth to rough. Grit blasting is widely used for finishing surfaces to be treated by enameling, lacquering, plating, painting or other coating. Tool life and machineability are improved, and defects in castings are disclosed when grit is used for cleaning. Advantages claimed for metallic blast cleaning are:

1. **Quantity required.** As a rule, 100 lb. of steel shot or grit will do the work of two tons of blasting sand. The shot or grit is used over and over, the break-up rate being much slower than that of sand.
2. **Purchase price.** The average cost of steel abrasive is about half that of blasting sand, even though the unit cost of metal is much higher, because of the 40 to 1 use ratio. There is also considerable difference in freight charges, unloading, storage, and shop handling costs.
3. **Dust abatement.** Metallic abrasive gives off less dust, resulting in cleaner blasting rooms, better vision for operators, no danger of silicosis, reduction of ventilation requirements and elimination of silica dust surface of parts.
4. **Nozzle life.** As a rule, fine and light abrasives, such as sand



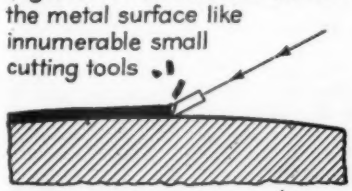
Angular edges on metallic grit cut scale from the surfaces cleaned. Resultant finish varies from smooth to rough, depending upon grit size used

AIR PRESSURES FOR BLAST CLEANING
(Using ⅜-in. Diameter Nozzle)

Type of Material To Be Cleaned	Flint Sand Abrasive	Metallic Abrasives (Steel Shot or Grit)	
	Pressure (Lb. per Sq. In.)	Pressure (Lb. per Sq. In.)	Size & Type of Abrasive
Steel Castings	70 to 80	—	—
Steel Forgings	70	—	—
Steel Plate	30 to 40	40 to 50	No. 50-Grit
Malleable Iron	60	60	No. 26-Shot
Cast Iron	60	60	No. 26-Shot
Aluminum	40	40	No. 50-Grit
Brass	40	50	No. 50-Grit
Bronze	50	50	No. 50-Grit

Note: Size of metallic shot or grit given in American Galion sizes.

Action of steel grit: The angular edges cut the scale and scratch the metal surface like innumerable small cutting tools



RATE OF DELIVERY OF ABRASIVES WITH DIFFERENT AIR PRESSURES

Dia. of Nozzle (in.)	Air Pressure—Pounds Per Square Inch											
	30	40	50	60	65	70	75	80	85	90	95	100
Sand Delivered—Pounds Per Minute												
1/8	0.8	1.3	1.7	2.2	2.5	2.8	3.1	3.4	3.6	4	4.3	4.6
3/16	1.9	3	4	5	5.6	6	7	7.6	8	9	9.5	10
1/4	3.3	5	7	9	10	11	12	13	15	16	17	18
5/16	5	8	11	14	16	17	19	21	23	25	27	29
3/8	7	11	16	20	23	25	28	30	33	36	39	42
7/16	10	15	21	27	31	34	38	41	45	49	53	57
1/2	13	20	28	36	40	44	49	54	59	64	69	74
9/16	17	25	35	45	51	56	62	68	74	81	87	94
5/8	21	31	43	56	63	70	77	84	92	100	108	115
11/16	25	38	52	68	76	84	93	102	111	120	130	140
3/4	30	45	62	80	90	100	110	120	132	144	155	166
Metallic Abrasives Delivered—Pounds Per Minute												
1/8	1.5	3	4	5	5	6	6	7	7	8	9	9
3/16	4	6	8	10	11	12	14	15	16	18	19	20
1/4	7	10	14	18	20	22	24	26	30	32	34	36
5/16	10	16	22	28	32	34	38	42	46	50	54	58
3/8	14	22	32	40	46	50	56	60	66	72	78	84
7/16	20	30	42	54	62	68	76	82	90	98	106	114
1/2	26	40	56	72	80	88	98	108	118	128	138	148
9/16	34	50	70	90	102	112	124	136	148	162	174	188
5/8	42	62	86	112	126	140	154	168	184	200	216	230
11/16	50	76	104	136	152	168	186	204	222	240	260	280
3/4	60	90	124	160	180	200	220	240	264	288	310	332

Note: The above values are based on uniform flow of abrasive and constant air pressure at the nozzle.

and artificial abrasives, wear blast nozzles faster than coarse abrasives. Metallic shot causes the least wear, grit is more severe, and fine sand and artificial abrasive cause the most wear. Replacement of nozzles is an expense that involves cost of nozzle, renewal time, down time of equipment, and increased air consumption. On the average, nozzles will last three to four times as long with metallic shot as with blasting sand.

Because of its peening action on the surface of parts blasted, shot blasting is usually far less suitable for preparing parts for wet-process enameling than steel grit. Sharp points of the grit cut minute chips from cast iron, producing a matte finished surface, the texture of which can be varied by changing screen size of the grit. However, pulverized cuttings from cast iron have a tendency to leave a graphitic smudge on the casting surface which contaminates the abrasive and causes trouble in some types of enameling.

Elimination of this smudge has been accomplished by passing the abrasive over a shaking screen of about 70-mesh. The screening method is said to be more positive and effective than trying to remove smudge by pneumatic action.

Some manufacturers have had trouble using steel abrasives because of moisture in the compressed air. However, newer types of compressed air equipment have eliminated this trouble and older types usually can be equipped with separate moisture separators.

New shot will break down in use and make a percentage of grit. It is best to add new shot or grit at frequent intervals to maintain a uniform mixture and replace fines carried off in the exhaust. Finishes can be varied by using two sizes of shot or grit, or a percentage of one with the other. Shot hits harder in breaking down scale and burnt-in sand on castings and forgings. Shot produces an indented but fairly smooth surface. Heavy grits produce a rough surface. Fine grits and dust produce a matte finish.

Opinion varies as to relative merits of metallic abrasives and silica sand for blast cleaning. Some users say that silica sand does a better job from the standpoint of appearance. Others claim that steel grit or shot does the best work. There are still others who are of the opinion that there is no difference in the quality of work, but that metallic abrasives are better from an economic standpoint.

No one abrasive is best for all blast-cleaning operations. Each type abrasive has its place, and there is considerable overlapping, especially between sand and steel. In general, the same sizes of abrasives are used in air-blast equipment and centrifugal-blast equipment to secure like results. However, the centrifugal process is more rapid because up to ten times as much abrasive is delivered to the work under approximately the same conditions of abrasive velocity.

RECOMMENDED SIZES OF METALLIC ABRASIVES FOR AIRLESS WHEELABRATOR ABRASIVE BLASTING UNITS

(Numbers are American Steel Abrasive Co., Galion, Ohio)

Type of Material To Be Cleaned	Type of Abrasive	
	Metallic Shot	Metallic Grit
Castings		
Average Grey Iron	No. 20	———
Average Annealed Malleable Iron	No. 20	———
Light Grey Iron	No. 22	———
Light Annealed Malleable Iron	No. 22	———
Brass	———	No. 60
Die Castings	———	No. 60
Aluminum	———	No. 60
Steel	No. 20	———
Forgings		
Medium and Heavy	25%-No. 19 75%-No. 20	———
Light (Coil Springs, Etc.)	No. 28 or No. 30	———
Heat-Treated Forgings		
Semi-Rough Finish	50%-No. 22 50%-No. 25	———

If after consideration of the surface quality desired after blast cleaning there remains a choice of abrasives available, by type and make, the final determining factor is the lowest cleaning cost per ton of castings or other parts handled.

A study to determine the blast abrasive that is most economical per ton of parts cleaned should consider the following factors:

1. Cost of abrasive at point of use (includes purchase price, freight, unloading and storage and handling costs).
2. Cost of electricity and compressed air.
3. Cost of labor.
4. Use of equipment and its maintenance.
5. Plant and supervision overhead.
6. Loss of abrasive due to breakdown in use.

In addition, hygienic (dust) conditions must be considered.

Nozzle wear is a large item of maintenance in blast cleaning with compressed air. Nozzle wear also adds greatly to compressed air cost, because ordinary nozzles are cut so rapidly by the abrasive stream that blasting efficiency falls greatly and large volumes of air must be supplied to maintain velocity of the stream when nozzle life is near its end. High quality nozzles have a life of at least 200 hr., although many last longer. Recently nozzles have been made of ceramic and other materials, such as boron carbide, and these promise to reduce maintenance due to nozzle wear.

Maintenance cost on centrifugal blast equipment involves replacement of wheel parts, including blades, impellers and control cages, liners and deflectors, as well as work-carrying devices such as table parts and fixtures. While maintenance cost of equipment of this type may seem high as compared with air-blast equipment, cost of cleaning by this method is said to be 40 to 60 percent less.

The quantity of abrasive that breaks down in use and is removed by screening and by the dust collector is an important factor in the cost of blast cleaning and must be considered.

ABRASIVES AND AIR PRESSURES FOR VARIOUS CLASSES OF WORK

(Based on Experience of Users and Recommendations of Suppliers)

Type of Material To Be Cleaned By Blasting	Finish Required On Work	Ordinary Sand Abrasive	Silica Flint Sand	Aluminum Oxide Abrasive	Metallic Shot Abrasive	Metallic Grit Abrasive
Grey Iron Castings	Fine	25-35	60	—	—	55
	Coarse	—	—	—	60	—
Malleable Iron Castings	Fine	—	60	—	—	55
	Coarse	—	—	—	60	—
Steel Castings	Fine	—	70	—	—	60-80
	Coarse	—	—	—	60-85	—
Enameling, Parkerizing, Etc.	Fine	—	60-80	—	—	60-80*
Steel Stampings, Sheet Metals, Etc.	Fine	—	30	—	—	40
Outdoor Blasting (Abrasive Used Only Once)	Fine	25-35	—	—	—	—
Brass and Bronze	Fine	—	—	—	—	50
	Coarse	—	—	—	60	—
Aluminum Alloys	Fine	—	—	—	—	40
	Coarse	—	—	—	50	—
Magnesium Alloys	Fine	—	—	40	—	—
	Coarse	—	—	—	—	—
Plastics	Fine	—	20	—	—	—
Forgings	Fine	—	70	—	—	60
	Coarse	—	—	—	70	—

*A mixture of grit and sand sometimes is used.
Note: All pressures shown are in pounds per square inch.

RECOMMENDED SIZES OF METALLIC ABRASIVES

(Numbers are American Steel Abrasive Co., Galion, Ohio)

Type of Material To Be Cleaned	Shot						Grit						
	19	20	22	25	28	30	14	18	38	45	60	90	120
XCast Iron													
Lg. castings with cores	X	X	—	—	—	—	X	X	—	—	—	—	—
Surface sand only	—	X	X	—	—	—	—	X	X	—	—	—	—
Medium-size castings	—	—	X	—	—	—	—	—	X	—	—	—	—
Small castings	—	—	—	X	—	—	—	—	X	X	—	—	—
Malleable Iron													
Large	—	X	—	—	—	—	—	X	—	—	—	—	—
Medium and small	—	—	—	X	—	—	—	—	X	X	—	—	—
Cast Steel													
Lg. castings with cores	X	—	—	—	—	—	X	—	—	—	—	—	—
Medium-size castings	—	X	—	—	—	—	—	X	—	—	—	—	—
Small castings	—	X	X	—	—	—	—	X	X	—	—	—	—
Cast Brass													
Large castings	—	—	—	X	X	—	—	—	—	X	X	—	—
Medium and small	—	—	—	—	—	X	—	—	—	—	X	—	—
Cast Aluminum	—	—	—	—	—	—	—	—	—	—	X	X	—
Cast Magnesium	—	—	—	—	—	—	—	—	—	—	—	X	X
Forgings													
With heavy scale	—	X	X	—	—	—	—	—	X	X	—	—	—
Shafts and axles	X	X	—	—	—	—	—	—	X	—	—	—	—
Rods and small parts	—	X	—	—	—	X	—	—	X	—	X	—	—
Heat-treated forgings	—	—	—	—	—	X	—	—	—	X	X	—	—
Gears and tools	—	—	—	—	—	—	—	—	—	—	X	X	X
Stove Plate													
Clean	—	—	—	—	—	—	—	—	X	—	—	—	—
For enamel	—	—	—	—	—	—	—	X	X	—	—	—	—
De-enamel	X	X	—	—	—	—	—	X	—	—	—	—	—
Castings—Galvanized, Etc.	—	—	—	—	—	—	—	—	—	X	—	X	—
Stampings—Galvanized, Etc.	—	—	—	—	—	—	—	—	—	—	X	—	X
Structural Steel													
Shapes	—	X	—	—	—	—	—	—	—	X	X	—	—
Bars and plates	—	—	X	—	—	—	—	—	X	—	—	—	—
Billets	—	X	X	—	—	—	—	X	X	—	—	—	—
Strip	—	—	—	—	—	—	—	—	—	—	—	X	X

Old Argument Involving Irresistible Force Is Ending

BY D. J. STRUVEN

REFERRING to what happens when an immovable body is met by an irresistible force:

In the absolute sense there is no such thing as an irresistible force, as a greater force may always be conceived as against any designated amount. Likewise, there is no such thing as an immovable body, or, in fact, a motionless body in the absolute sense, for however great the force required to move a designated mass against its own inertia, that force may be conceived, or supplied.

Electronic Applications Find Wide Use in Metal-Working

BY R. M. SEROTA, ELECTRONIC DEVICES SECTION, ALLIS-CHALMERS MANUFACTURING COMPANY

While relatively new, industrial electronics has already filled practical shop needs. The field of use seems to be limited only by the ingenuity of the engineer

WITH THE PRESSURE on for greater production of many complex and precision-built products, industry is ready to adapt any aid that promises either to increase production, improve the product or product performance, reduce costs, or make possible the use of less critical materials. For these reasons industrial electronics has made great strides in the past few years. A word of caution, however, may not be amiss. Electronics is not a cure-all for all the problems confronting industry. There are many instances where conventional methods are altogether satisfactory and where the electronic counterpart is inferior or, at best, no improvement, and whose use therefore cannot be justified.

The electronic indicator is fundamental in most electronics applications since frequently only the manner in which the output of an indicating circuit is employed determines whether the unit is an indicating or controlling device. The role of an indicator is to provide the means of measuring some phenomenon or property such as revolutions per minute, vibration, temperature, pressure, velocity, acceleration, displacement, strain or torque. It may be required to measure the magnitude or the rate of change of one of the above—in any case an electronic instrument can usually be designed to do the job.

Mechanical to Electrical

Since all electronic indicating and control circuits require control voltages, it is frequently necessary to convert non-electrical phenomena into corresponding electrical phenomena. The manner in which the conversion is to be made taxes the ingenuity of the designer to the limit.

The phototube or photocell, probably more than any other single device with the exception of the triode tube, opened the doors of industry to electronics. While the idea of having the interruption of a light beam cause an alarm or perform some other simple operation is not new, yet it is surprising how the possibilities of such a device have gone neglected.

As a safety device on machines of all kinds it is unsurpassed. A simple light source, a few lenses, a phototube, with or without an amplifier, and a relay or two are all that is required to provide safety control for shears, presses, forging hammers, punches and many other types of equipment where there is danger of the operator maiming himself. The light beam is directed so that the machine is inoperative during such time as there is danger to the operator.

Such a protective device is simple, inexpensive and quite foolproof. Compare this with the cumbersome and costly guards in use in the plants today. Frequently the present guards impair the efficiency or otherwise irritate the operator so that he elects to remove the guard or cause it to be inoperative, resulting in continued accidents on machines that are supposedly protected. The phototube relay can be inconspicuous and is a sentinel that remains on the job irrespective of any prejudice on the part of the operator.

This same mechanism provides an excellent limit switch which can be used on any equipment regardless of size. Its greatest advantages over conventional switches are that it requires no torque, has no inertia, requires no physical or electrical contact with the mechanism, and its adjustment is not affected by wear. Many adaptations of this electronic limit switch have been made. Elevators can be stopped within less than 1/16 in. of the desired level regardless of the load. Bulk ingredients can be automatically measured out either by weight or volume with a rapidity and accuracy unsurpassed by other means. Electronic register controls for wrapping machines makes possible rapid wrapping of packages with paper cut exactly to size and position with respect to the printed pattern.

Still another application of the photo relay is in detecting breakages, pin holes and other flaws in metal sheets and foils. The light sources are placed on one side of the material while the photocells are on the other. A flaw can sound an alarm or stop the machine. The relay circuit can be so connected as to cause a marking on the sheet at the place of the flaw or else to cause that particular piece containing the flaw to be rejected at the time of cutting and stacking.

Parts Counted Electronically

One of the earliest electronic applications is the counter which employs a photo relay actuating either a mechanical or magnetic counter. These are satisfactory for applications where the rate is not excessive. For those applications which require a higher rate, an electronic multiplier circuit can be used. Such a circuit causes the mechanical or magnetic counter to register the groups of 2, 4, 8 etc. Thus, to determine the number of pieces which have passed through the light beam, it is only necessary to multiply the counter reading by a factor. In such a system an inaccuracy is introduced whose maximum is one less than the number comprising a group. Over a period of time such an error is usually inconsequential. Again, as in the case of all photo-electronic applications, no contact with the objects is necessary.

Electronic transmittancy indicators and recorders fill a long felt need. These devices measure the ratio between light which is transmitted through the material and the light which strikes the surface nearest the light source. Such devices are used to measure the transmittancy of paper, glass, fabrics, plastics, etc. Special adaptations include smoke indicators, turbidity meters, density and concentration meters.

Electronic frequency meters can be had in ranges up to 50,000 cycles per second which give direct and continuous indication and have a means of utilizing the harmonics of the line frequency for calibration. These frequency meters, in conjunction with a photocell and a light source, can be used to indicate the r.p.m. of any rotating equipment without in any way affecting the operation of the equipment. Either direct or reflected light can be employed. Thus, a white marker painted on a shaft, wheel, pulley or gear is adequate to produce enough light variations to activate the frequency meter with the aid of a small amplifier. Again, no moving parts, no inertia or torque and, therefore, no change in loading conditions.

While the photocell is an important component in many electronic devices it is by no means common to all of them. In the field of thermal measurements, the change in resistance as a function of temperature may be utilized to unbalance a bridge circuit and thus make it possible to provide a temperature indicator which may have an adjustable trip or alarm circuit as an additional feature. Such units can be used to monitor motor, generator, oven, vat or bearing temperatures continuously without the need of any manipulation. In addition, the indicator may be located at some convenient location well removed from the object under test.

Vibration has been a rather difficult problem so far as measurement is concerned. However, with the aid of pickups similar to those used in phonographs, it becomes a relatively simple problem to design an electronic indicator which will show the magnitude or frequency of vibrations in any plane and, in addition, provide an alarm or trip a breaker in the event the vibration becomes excessive.

With the aid of the pickup and a cathode ray oscilloscope, exact determinations of the vibrations can be made. At least one such unit is being used in measurements of the effects of mechanical shock. The oscilloscopes together with photo-recording equipment, give graphic records of even the shortest transient effects encountered.

Useful in Motor Control

A field in which electronic controls are rapidly making a name for themselves is motor and generator control equipment. The advantages of such electronic controls and regulators are: (1) no moving parts, (2) high sensitivity, (3) no mechanical inertia, (4) low control energy required, (5) low maintenance cost and (6) easy and convenient manual control.

Voltage regulators as a rule obtain their control voltage by the comparison method. That is, the output voltage of the generator is compared to a standard or reference which might be either a battery or, more frequently, a gaseous glow tube. The difference in voltage is applied to grids of thyratron tubes, usually through an amplifier, thus controlling the average current conducted or rectified by the tubes. In the event the generator is large, the control is applied to the field of the pilot exciter instead. The regulator, as a rule, is equipped with a small control, the size of a volume control on an average radio, by means of which the voltage output of the generator can be adjusted to the desired value. Simple anti-hunt circuits in the regulator proper prevent hunting. The output voltage of the generator can thus be kept constant regardless of the load conditions prevailing. In addition, the control acts instantaneously for all practical purposes.

Speed regulators for motors are of two general types—fixed and variable speed. As a general rule a.c. synchronous motors are used where constant speed is desired but, in some cases as in the d.c.-a.c. inverter, it is necessary to maintain the speed of the d.c. shunt driving

Being assembled here is the interior of a 25-kilowatt high-frequency generator for induction heating. The machine will convert 60-cycle power to 400,000 cycle power which will be used in a work coil for annealing, brazing, soldering or melting metals

motor to obtain an a.c. voltage of constant frequency. In such case the alternator output voltage is fed to a balanced bridge. Change in frequency causes the bridge to become unbalanced and thus supply a control voltage proportional to the deviation in frequency. This voltage is then fed to a power amplifier having sufficient output to control the field of the driving motor. Regulation of better than ¼ percent has thus been obtained.

The more usual applications call for a variable-speed motor. With the aid of an electric tachometer attached to the motor a voltage is obtained which is proportional to the speed. As in the voltage regulator, this voltage is compared with a reference voltage, and the difference applied to the grids of the thyratrons supplying the field current for the motor. If the armature current is likewise supplied by a rectifier, a d.c. shunt motor, with its excellent regulation characteristic, can be operated from an a.c. source. In such a case a current regulator might be employed to maintain a given current which can be adjusted over a large range of values. This current regulator, in effect, provides a constant-torque motor regardless of load.

Between the speed control and the current regulator, it is possible to obtain complete automatic regulation of the d.c. shunt motor and in addition have it operate from an a.c. source.

Speed Ratio Kept Constant

An interesting adaptation of the speed regulator is one which the speed of one motor is controlled in such a manner as to have a constant ratio with respect to the speed of a second motor. The ratio is adjusted by means of a simple variable resistor and remains substantially constant over a large range of loads without benefit of any mechanical linkage between the two. The idea is feasible for d.c. motors of all sizes—the two not necessarily being of identical capacity.

The speed regulators operating in conjunction with photo cells are being used in the steel industry as loop and tension regulators. Light beams are so placed that as the loop passes outside of previously determined limits the beams are interrupted. This interruption causes the photo relay to excite the speed regulators in a manner such as to bring the loop back within the prescribed limits. As in so many other applications, no contact, either electrical or mechanical, between the material being processed and the control is necessary.

Advantages of high-frequency induction heating are:

1. No skilled operator is necessary.
2. Uniformity of work is unsurpassed by other methods.
3. Reduces costs by brazing parts to form units which formerly had to be machined from one piece.
4. Contour case hardening of small depth.
5. Little or no distortion because of rapid heating.
6. Makes possible the economical brazing of small components which previously could not be brazed by any other means.
7. Increases production by reducing time required to do a particular job.
8. Increases production and costs by reducing materially the number of rejects.

The most recent and probably the most spectacular of electronic developments is high-frequency induction heating. As early as 1890 and 1900, it was shown that iron or steel could be heated by placing it in a strong alternating magnetic field but not until recent years has the idea been applied to any great extent of industry. Manufacturers of vacuum tubes were the first to use high frequencies for heating of the tube elements during evacuation to drive off the absorbed gases. Today, however, these high frequencies are being employed to do numerous jobs among which are brazing of ferrous and non-ferrous metals, soldering, heat-treating, case hardening, sealing of glass to metal and preheating before forging.

The developed heat is due to two phenomena—eddy currents and hysteresis losses, but, since ferrous metals lose their magnetic properties at a temperature of approximately 1300 F. and non-ferrous metals have little or no hysteresis losses, the eddy currents can be considered to do most of the work. Since eddy currents are developed in all conductors, ferrous or non-ferrous, all metals can be heated to a greater or lesser extent depending upon their resistance. It is not uncommon to braze steel, copper, brass, silver and even aluminum with a high-frequency induction heating unit.

The particular advantage of high-frequency induction heating is that the heating can be pretty well confined to the desired area. High-frequency currents tend to travel on the surface of the conductor. Thus, the conductor heats from the outside toward the center. If the power available is sufficient and the frequency is high enough, the conductor becomes red on the surface in a few seconds. Since the interior of the conductor is heated by conduction, it is possible to have a very thin layer of the surface red hot while the interior remains at its initial temperature. If the conductor is quenched at this point the outside surface becomes hardened. It is possible in this manner, to case harden to a depth of only a few thousandths of an inch. In addition, the case hardening will follow the contour of an irregular object, such as a gear, thus giving a hard wearing surface and still maintaining the original toughness of the steel forming the body of the tooth. The depth to which hardening takes place is a function of time, power, frequency and size of piece. The greater the power and size of piece, the higher the frequency and the lower the time, the thinner the case hardening. With powers of 10 to 20 kilowatts and frequencies of the order of 400 kilocycles it is possible to harden to a depth of a few thousandths of an inch.

At the present time the electronic high-frequency generator is economical on moderate and small sizes of work. For large work the power requirements are high and since costs of the electronic generators and their power ratings do not have a linear relationship, an optimum point is reached. At present, units can be built and used economically with powers ranging up to approximately 50 to 100 kw. The units lend themselves beautifully to mass production and are certainly doing their part to hasten the day of victory.

Induction heaters operating at much lower frequencies (1000 cycles) and employing mercury vapor rectifiers can be built up in units having very large capacities. These prove satisfactory where the work is large and where it is not necessary to confine the heat to a thin surface layer.

Abstracted from a paper presented before the National Electronics Conference.

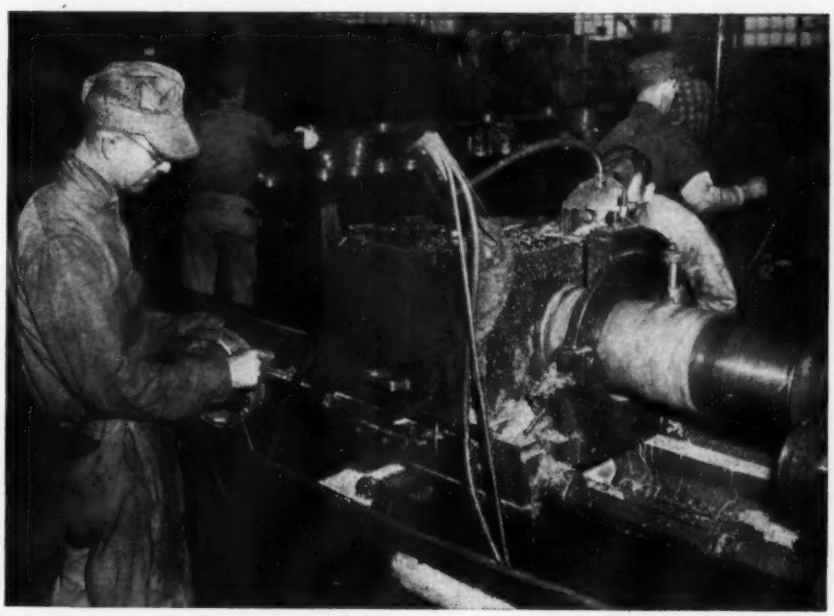
Modified Lathes Produce Driving Bands

Jib cranes provide convenient means for loading the 10-ft. gilding-metal tubes into a battery of large engine lathes

THROUGH a combination of circumstances, the Huntington W. Va. Works of the International Nickel Company has been able to achieve high output of driving bands for 8-in. shell. The bands are cut from extruded gilding metal tubing produced at Huntington to high standards for size, concentricity, straightness and quality of the internal surface. As a result, a fast sawing method is feasible, and no machining of the I.D. is required before application of the band to the projectile.

The tubing, 8.900 in. O.D., 7.945 in. I.D., is produced on a 4,000-ton extrusion press. In the driving-band department, the tubing is cut into 2-in. lengths by a battery of Lehmann "Hydratrol" lathes, at the rate of 800 to 900 pieces per machine per 8-hr. shift. The tubing is gripped by a three-jaw expanding chuck at the headstock, and the other end is held by a steadyrest equipped with spring-backed jaws. Straightness of the tubing is such that it can be driven at 195 r.p.m. in a direction opposite to the saw, mounted on the carriage. This saw is a segmental type, 12 in. in diameter, and has 82 teeth with a radial cutting edge.

Burrs are removed from the bands, which are then put on a slat conveyor for movement to the expander. This machine has an expanding head equipped with four jaws, which are spread ⅜ in. by a four-lobe cam. The vertical camshaft of the expander is driven at 2 r.p.m. by a gearmotor. Thus, the expanding head operates at each quarter turn of the camshaft, permitting an output of eight bands per min. The bands are expanded from 0.030-0.080 in. on the diameter. After expansion, the bands are ready for application to the shell, no machining of the I.D. being necessary. This economy of effort is made possible because of the original high quality of the internal surface of the hot-extruded tubing. Thus, the expansion process merely serves to assure a truly round internal diameter.



A 5-hp. saw built onto the carriage of a Lehmann "Hydratrol" cuts off between 800 and 900 bands for 8-in. shell in a shift. Burrs are easily removed from the bands with hand tools

By expanding the driving band from 0.030-0.080 in. on the diameter, it becomes unnecessary to machine the I.D. of the hot-extruded part before application to the projectile

Two Aircraft Engines Built On One Assembly Line

Chevrolet's car-assembly lines turned out many sorts of body types and equipment options; the same scheduling methods control flow of subassemblies and parts for assembly of P. & W. engines

TWO SIZES and three models of Pratt & Whitney aircraft engines are now being turned out on a single production line at Chevrolet's Aviation Engine Plant No. 1, Tonawanda, N. Y. Although somewhat of an innovation in the aircraft-engine industry, what is being done at Tonawanda is an old story to Chevrolet manufacturing officials. Basic principles of the set-up follow automobile practice, wherein a coordinated flow of materials brings the components of a vehicle to the final assembly line at the right time and in the right place.

Originally the Tonawanda plant's war assignment was production of a 14-cylinder Pratt & Whitney engine. Recently the 18-cylinder R-2800 engine was superimposed on the manufacturing schedule for the smaller engine, although none of the parts of the two engines is interchangeable. Production of 14-cylinder engines (50,000 have been built in two years) was maintained while an extensive plant rearrangement and retooling program was carried on for the R-2800 engine. In five months and 18 days, the first of the big engines was turned out, not on a second assembly line as some thought would be necessary but on the same line as two models of 14-cylinder engines.

In order to produce different sizes and models of a basic product on a single assembly line, Chevrolet manufacturing officials list these essentials:

1. Organized and systematic scheduling.
2. Adequate floorspace.
3. Use of the number control system.
4. Use of a scheduling board.

Scheduling is the keystone of the whole coordinated production process. The number of 18-cylinder and 14-cylinder engines, and types of the latter, to be turned out in a full day's production is determined in advance. The schedule is listed on the scheduling board before the beginning of the first of the day's two eight-hour shifts, and covers the number of engines for each shift.

Next to actual scheduling of production, application of the number control system is of prime importance. Upon it depends smooth, uninterrupted flow of materials from beginning to end of the assembly line. Each engine bears a model number, the sequence of which is determined according to the government contract. Each part and subassembly for each engine must be identified by a corresponding number. This assures that the proper part or subassembly is at the proper station on the assembly line at the proper time. Any discrepancy would cause a serious disruption of production. Special training of personnel and careful double checking all along the line are exercised to safeguard accuracy of the system.

Flowing into the receiving depart-

Eighteen subassemblies and a much larger number of individual parts are placed on benches near the "green" assembly line or flow to it on conveyors at scheduled rates so that a steady specified pace of assembly is maintained during the shift

ment of the Tonawanda plant, all material for all models of aircraft engines being built are unpacked and immediately inspected. All that successfully pass inspection are routed into "bond" storage. From here they are scheduled into production.

The engine begins its journey down the "green," or initial assembly line, when the blower crankcase and stud assembly is put together. Included in this subassembly are the blower crankcase and bushing assembly, studs, plugs, engine mounting brackets, and the blower internal oil pressure pipe and bracket. Next, the intake port and oil passage covers, coming in from the opposite side of the assembly line, are put in place. Then follows the impeller assembly which includes the impeller, impeller shaft, oil seal front and rear ring carriers. As assembly progresses on the "green" line a total of 18 subassemblies and a much larger number of individual parts are available on benches at the proper stations or flow to the line on conveyors at the proper time.

Roughly, the "green" line assembly, as is indicated above, starts with the blower crankcase and stud assembly and ends with the installation of the carburetor and starter.

The engine then is moved into a test cell, where it is test-run at varying speeds for four hours and 45 min. This is called the "green test."

Teardown Reverses Process

Following the test run, the engine moves back to the teardown line. Here, in strict accordance with the scheduling and number control plan, the engine is disassembled by reversing the original assembly process insofar as is practical. For example, on the teardown line, the carburetor and starter, last of the parts to be installed, are the first to be removed. Last to be dismantled is the blower crankcase and stud assembly, which constituted the first assembly on the "green" line.

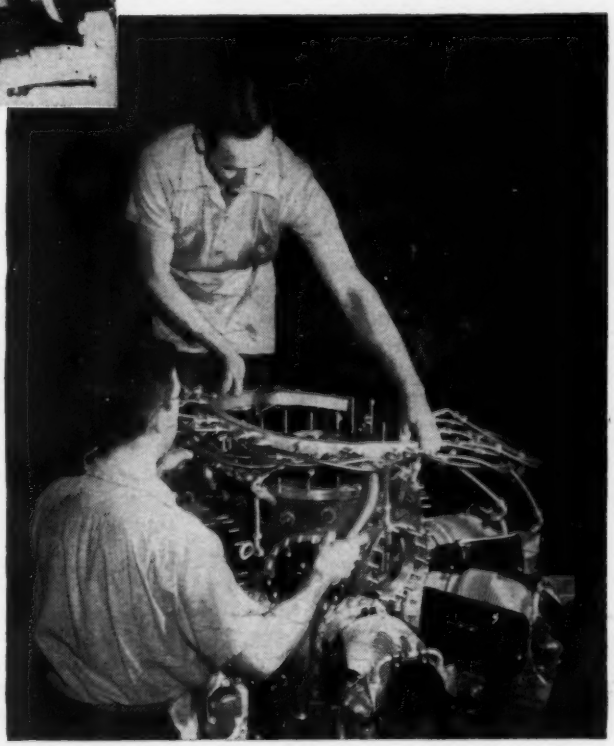
Following the pre-arranged scheduling, and, guided every step of the way by the number control system, the parts and subassemblies, as they are removed, again are inspected and systematically moved to their proper stations on the final assembly line.

Final assembly, with minor exceptions, duplicates the process of green assembly, starting with the blower crankcase and stud assembly and ending with installation of the carburetor and starter. Final assembly is followed by a final test of two hours and 45 min. or longer, depending on the size of the engine. After thorough preparation, the engines are packed for shipment to their final destination.

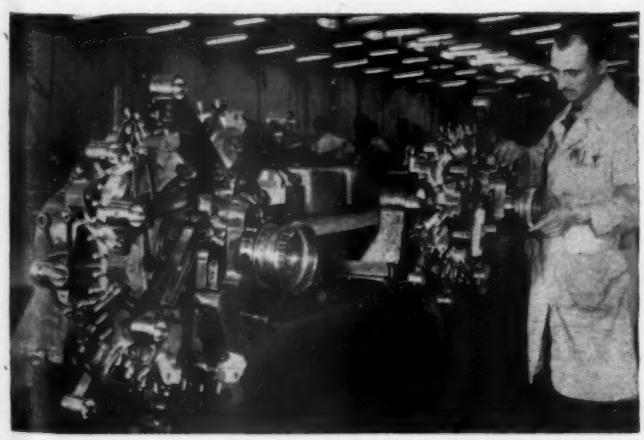
Thus is illustrated one more instance of where mass production techniques, perfected and long used in the automative industry, have contributed importantly to the efficiency of war production.

After final assembly of cylinder-head and barrel units, they are inspected and placed on a conveyor line parallel to the engine "green" assembly line, to be picked off at the proper station

Through careful scheduling and the number control system, the electrical harness and other parts and subassemblies reach the proper assembly point at the right time



Below—Power-section assembly is carried out at an oval track, around which the fixtures are moved by conveyor. Crankshaft, rods, gears and other parts are banked within easy reach of operators for installation as the fixtures move from station to station



Selective Fits Are Easily Specified If Simple Instructions Are Followed

BY JOHN GAILLARD, MECHANICAL ENGINEER, AMERICAN STANDARDS ASSOCIATION

If the shop cannot work to hole and shaft tolerances on prints, or their cost is excessive, the use of selective fits will allow larger manufacturing tolerances which are split in several zones

DESIGN of mechanical equipment may raise the question whether the fit between two mating parts may be secured by interchangeable assembly or selective assembly. Interchangeable assembly consists in random mating of holes and shafts as they come from production lines, with sizes lying within shop tolerances specified on the drawing. Selective assembly, on the other hand, involves three distinct steps: (1) subdivision of part tolerances into an equal number of zones; (2) sorting holes and shafts to size on the basis of these zones; and (3) assembly of holes and shafts that belong in corresponding tolerance zones, the smallest holes being mated with the smallest shafts.

Disadvantages of Selective Assembly

The choice between interchangeable assembly and selective assembly must rest upon a careful appraisal of the advantages and disadvantages of the two methods. Several disadvantages come to mind in respect to selective assembly. In the first place, establishment of selective fits is more complicated than fits between interchangeable parts. In addition to being assorted, the mating parts must be kept assorted until they are assembled. Servicing of a machine is more difficult; the replacement part must be fitted to the mating part still in service, or both parts must be replaced with a new matched set. On the other hand, when worn or lost, interchangeable parts may in general be replaced with a new part. Finally, assortment of parts on the basis of tolerance zones is unlikely to result in an equal number of holes and shafts in corresponding zones.

As a result of these disadvantages, a manufacturer may be inclined to avoid selective assembly. Sometimes he may go so far as to produce certain fits by random mating of parts. But he is bound to get an excessive number of bad fits, and probably scrap where tight fits are concerned, because of cracking the external parts. Sometimes the manufacturer has the opinion that selective assembly should be used only as a last resort, such as when interchangeable assembly is technically impossible. But this viewpoint does not give proper consideration to cost of manufacture. Thus, clarification of the conditions under which selective assembly is unavoidable may be helpful in remedying such situations.

In deciding between interchangeable and selective assembly, two main factors must be considered: (1) permissible variation in fit, and (2) the accuracy with which mating parts can be produced under regular manufacturing conditions, not special conditions applied to an experimental run. In some cases the required fits can be produced only by selective assembly. In others, interchangeable assembly is possible only if very close tolerances are maintained, which means higher production cost. As an alternative, selective assembly may be more economical, particularly because larger shop tolerances can be applied. Production cost may not be the governing criterion, however, if selective fitting unduly complicates servicing the product.

Designed for Specific Items

In general, selective fits must be designed to suit each case. They can be standardized only if produced under rather narrowly defined conditions. For example, the data for interference fits in Classes 6 (Tight), 7 (Medium Force) and 8 (Heavy Force and Shrink), given in the Tentative American Standard, "Tolerances, Allowances and Gages for Metal Fits" (B4a-1925), apply to two specific cases: the mating of a steel shaft with either a cast-iron hub or a steel hub. Also, it is assumed that the outside diameter of the hub equals twice the diameter of the hole. Different data apply if the designer must consider the problem of pressing a steel shaft into a thin-walled steel casting having a hub with an outside diameter equal to 1.2 times the hole diameter, or the assembly of a bronze bushing with an aluminum casting.

By collecting the basic data for such cases, companies may set up tables for selective fits required by their products. In time, selective fits which have found general application in an industry, may become recognized as "standard" fits. Yet, there always remain many selective fits for which the designer must write his own specifications.

How to Approach the Problem

The task of writing specifications for fits will be easier if the designer follows two steps. First, he should use a simple formula to determine for the specific case whether interchangeable assembly is possible or selective assembly must (or merely should) be applied. Second, if selective assembly is used and the basic requirements of the fit are known, shop tolerances of mating parts and the zones in which they must be divided can be determined by following a simple set of instructions.

Before using the formula mentioned, the designer must know what kind of a fit is required for the product in question. The minimum required clearance (allowance) of a running fit may be determined, for example, by the requirement of adequate lubrication. The maximum permissible clearance may be deter-

mined by proper alignment of the shaft in its bearings. Permissible variation in fit V is here the difference between the minimum required clearance and the maximum permissible clearance. A tight fit requires a minimum interference sufficient to secure the necessary grip for holding the two parts together when in operation. The maximum permissible interference may depend on the highest stress allowable in the material around the hole. Even if the smallest acceptable hole is mated with the largest acceptable shaft, there should be no danger of cracking the external part due to stresses upon assembly. Therefore, the permissible variation in fit V of a tight fit is equal to the difference between the minimum required interference and the maximum permissible interference.

A special group of fits that call for selective assembly are "neutral" fits, that is, those fits which in assembled condition should be neither loose nor tight, but just snug. Every practical man knows that such fits are difficult to produce because their permissible variation in fit is small. A shift in the direction of clearance may cause the fit to be too loose, while a shift in the other direction may lead to a tightness which, although slight, may be unacceptable. In writing the specification for such a fit, the designer will have to decide whether a variation from the neutral character of the fit is equally harmless in either direction, or else in what direction any variation must be prevented. In the latter case, a shift in the "harmless" direction should be restricted also to the smallest amount possible.

Whether we are dealing with a loose, a tight or a neutral fit, the permissible variation in fit V depends solely on the function that the mating parts are required to perform. The value of V must be determined on the basis of practical experience with the use of the product, and it is independent of the limits of accuracy within which the shop is able to hold the mating parts in production.

Tolerance on Assembly

If mating holes and shafts are held in the shop within tolerances H and S, respectively, this implies that the maximum possible variation in looseness or tightness of their fits—when the parts are mated at random—is equal to the sum of the tolerances, or $H + S$. This value may be called the tolerance on the hole-shaft assembly, or briefly, the tolerance on assembly A. For every fit, the maximum possible variation in fit is equal to the tolerance on assembly, or $A = H + S$. For example, if the hole is held within the limits 1.0000 and 1.0008 in., ($H = 0.0008$ in.) and the shaft, within the limits 0.9995 and 0.9990 in. ($S = 0.0005$ in.) the tolerance on assembly is $A = 0.0013$ in.

Depending on equipment available in the shop, there are practical minimum values for tolerances H and S within which parts of a certain kind (size, material) can be held under specific conditions (speed of production, surface finish, condition of production machinery). These minimum practicable shop tolerances will be designated by H^1 and S^1. Therefore, the minimum possible variation in fit that can be maintained for parts made in a given shop is $A^1 = H^1 + S^1$. If, for example, the closest shop tolerances that can be held in regular production are $H^1 = 0.0003$ in. and $S^1 = 0.0002$ in., the minimum practicable tolerance on assembly is $A^1 = 0.0005$ in.

In general, selective fits must be designed to suit each case. By compiling basic information for such cases, companies can set up tables of selective fits for their various products

The answer to the question when interchangeable assembly is possible and when selective assembly is required, can now be given in simple terms. When V is larger than, or equal to A^1, it is possible to apply interchangeable assembly. It means that the shop can be allowed manufacturing tolerances that are at least equal to H^1 and S^1, the closest the shop can maintain. When V is smaller than A^1, selective assembly must be applied. Therefore, if V, H^1 and S^1 are known, we can formulate the criterion as follows: If $V < H^1 + S^1$, selective assembly is the only possibility. Otherwise, either interchangeable or selective assembly is possible and while in general interchangeable assembly will be preferable due to its greater simplicity, there may be cases where the two systems should be weighed against each other, for example, on the basis of production cost.

Selective Clearance Fit

Suppose we have a clearance fit between mating parts with a basic diameter of 1 in., the required minimum clearance being 0.0001 in. and the maximum permissible clearance, 0.0005 in. Accordingly, for this fit we have: $V = 0.0004$ in. It is assumed further, that the closest practicable shop tolerances are $H^1 = 0.0005$ in. and $S^1 = 0.0003$ in., or $A^1 = H^1 + S^1 = 0.0008$ in. Since $V < H^1 + S^1$, selective assembly is unavoidable. This is shown also by diagram *A*, Fig. 1. Interchangeable assembly of holes H^1 (limits, 1.0000 and 1.0005 in.) and shafts S^1 (limits, 0.9999 and 0.9996 in.) which represent the most accurate work the shop can produce, would result in a maximum possible clearance of 0.0009 in., or more than twice the specified maximum permissible clearance.

Selective assembly applied according to diagram *B*, Fig. 1, however, meets the specified requirements. Here, the hole and shaft have the same shop tolerance, $H = S = 0.0006$ in., the hole limits being 1.0000 and 1.0006 in. and the shaft limits, 1.0003 and 0.9997 in. The tolerances H and S are each divided into three zones of 0.0002 in. Holes with sizes in zone h_1 are mated with shafts having sizes in zone s_1, and so on. Selected fits are thus established whose clearance can be no less than 0.0001 in., nor more than 0.0005 in., or $V = 0.0004$ in., as specified. The effect of selection is shown by diagram *C*, Fig. 1. Three separate groups of fits are obtained, each having hole and shaft tolerances of 0.0002 in., and a minimum clearance of 0.0001 in., as required.

Selective Interference Fit

The problem of establishing an interference fit is complicated by the fact that it is not merely dimensional. The minimum required interference, as well as the maximum permissible interference, must be considered as causes of deformation of the mating parts and stresses in the material resulting therefrom.

For example, assume that a ¾-in. steel shaft must be pressed into a steel bushing with an outside diameter of 1½ in.; length, 2 in. The designer is assumed to know that the requirements for this fit are: First, to secure the necessary holding power between the mating parts

when assembled. Experience shows that the force to be exerted when the shaft is pressed into the bushing shall be no less than 0.6 ton. Through computation, the corresponding interference is approximately 0.00023 in. To be on the safe side and also, to use a round number of "tenths," the designer adopts 0.0003 in. as the minimum required interference. Second, the maximum allowable stress in the bushing material is known to be 20,000 psi., and determines the maximum permissible interference. Its value is computed to be 0.00052 in. and is rounded to 0.0005 in. Thus, the difference between maximum and minimum interference fit is $V = 0.0002$ in. The shop's capacity for accuracy in producing holes and shafts is expressed by $H^1 = 0.0003$ in. and $S^1 = 0.0002$ in. Since $V < H^1 + S^1$, selective assembly is found to be unavoidable.

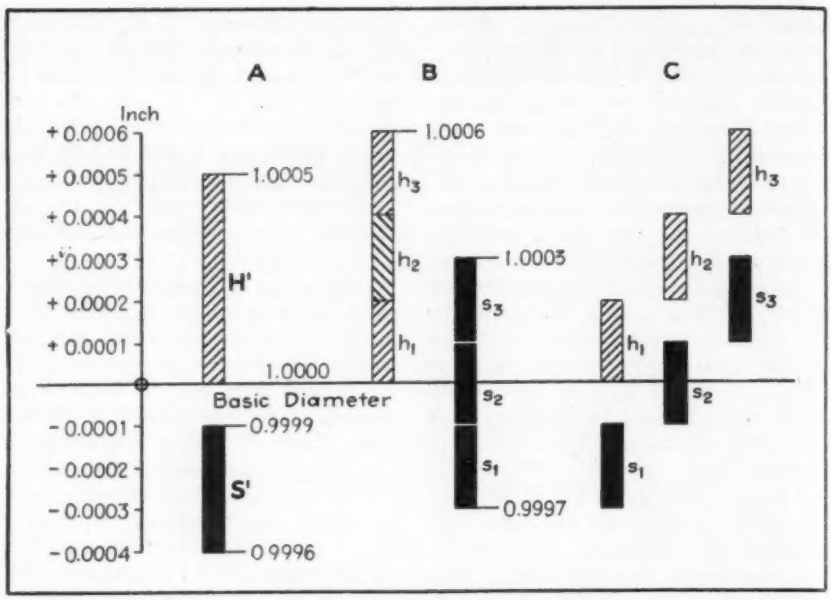


Fig. 1—Selective assembly applied to a clearance fit

To show what would happen if an effort were made to establish this interference fit without the parts being selected, diagrams *D* and *E*, Fig. 2, have been set up. In diagram *D*, hole A_1 and shaft B_1 are held within the closest possible shop tolerances. They have a minimum interference of 0.0003 in., which secures an adequate assembly force (approx. 0.78 ton) between the largest acceptable hole (0.7503 in.) and the smallest acceptable shaft (0.7506 in.). However, there will be a maximum interference of 0.0008 in. between the smallest acceptable hole (0.7500 in.) and the largest acceptable shaft (0.7508 in.). This corresponds to a maximum stress in the bushing of 30,930 psi. which exceeds the specified stress limit. Nor would the arrangement of diagram *E*, Fig. 2, solve the problem. Here, the maximum interference between hole A_3 and shaft B_3 is 0.0005 in., which corresponds to a maximum stress around the hole of 19,330 psi. However, the minimum interference is zero, since the maximum hole and the minimum shaft both have the size 0.753 in. This combination does not give a tight fit —much less an assembly force of at least 0.6 ton, as required.

Diagrams *G* and *K*, Fig. 2, show the set-up for selective assembly. The shop tolerances on hole and shaft (A_3 and B_3) are both equal to 0.0003 in., are divided into three zones of 0.0001 in. The shop limits for the hole are 0.7500 and 0.7503 in. and those for the shaft, 0.7504 and 0.7507 in. The groups of fits obtained through selective assembly, are shown in diagram *K*. In each group, the minimum interference is 0.0003 in., corresponding to an assembly force of 0.78 ton, while maximum interference is 0.0005 in. which corresponds to a maximum stress in the bushing of 19,330 psi.

As indicated by the examples of Figs. 1 and 2, the sum of the shop tolerances given on mating parts intended for selective assembly is at least equal to, and usually larger than the sum of H^1 and S^1, the closest tolerances the shop can hold. There are two main reasons for this. First, selective fits must have equal shop tolerances on hole and shaft. Consequently, the part limits are controlled by the largest of the values H^1 and S^1. Usually, a hole of a given size is more difficult to keep within a close tolerance than is a shaft. If this is the case, the shaft must be given a shop tolerance at least equal to H^1, merely because this is the minimum tolerance to which the hole can be held. The total tolerance on assembly thus becomes at least 2 H^1, which is larger than $H^1 + S^1$. Furthermore, if desired, the designer may increase the shop tolerances beyond the minimum values required. In Fig. 1, he could add, for example, two more zones h_4 and h_5 to the hole tolerance, and two more zone s_4 and s_5 to the shaft tolerance. The shop tolerance, on both parts would then become 0.0010 in., which may be more economical in production. The mating parts must be assorted, however, into five groups.

The advantage of being able to work within tolerances larger than those which the shop can barely maintain in practice merits consideration. It is a partial compensation for the more complicated procedure that must be followed in assembling components by selection.

Standard Approach to Problem

When the minimum and maximum clearances or interferences to be specified for a fit are known, as well as the closest degree of accuracy the shop can maintain in producing holes and shafts, it is rather easy for the skilled designer to specify a selective fit. The result will be such as given in diagrams *B*, Fig. 1 and *G*, Fig. 2. However, the specification of selective fits becomes much easier if a set of simple istructions are followed. These are given below and represent a standardized approach to the problem of specifying selective fits, even in those cases where the solution of that problem depends on individual data.

1. Let *X* be the minimum required clearance (or interference) of the selective fit under consideration and *Y*, the maximum permissible clearance (or interference).

2. Adopt the value, $Z = \frac{1}{2}(Y - X)$, as the width of the zones into which the shop tolerances on hole and shaft are to be divided. If the value *Z* thus computed contains a fraction of 0.0001 in., and it is desired to avoid "splitting a tenth," round the computed value *Z* downward to the nearest whole number of "tenths".

3. Find out what are the closest manufacturing tolerances H^1 and S^1 for holes and shafts of the size under consideration.

4. Divide *Z* into the largest of the

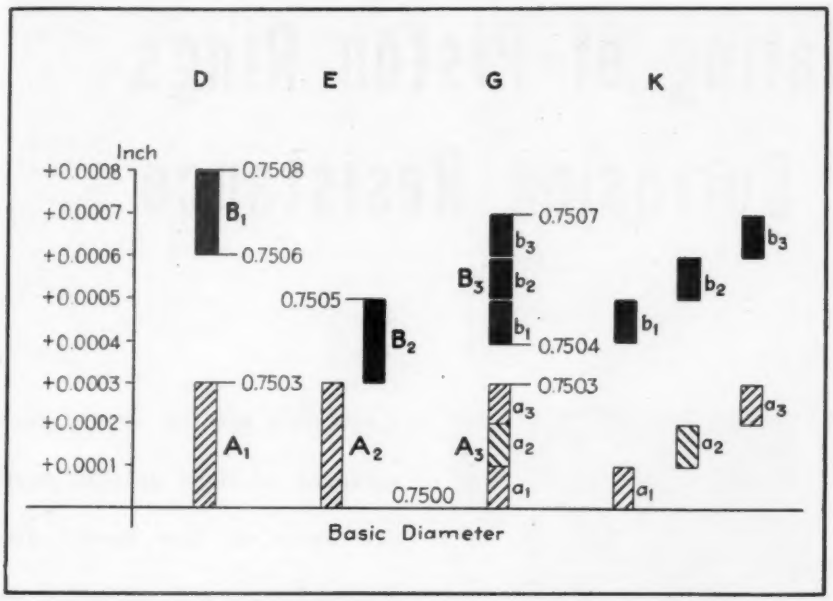


Fig. 2—Selective assembly applied to an interference fit

values H' and S'. If this results in a fraction, round the quotient upward to the nearest whole number. Let this be. N.

5. Adopt the value, N times Z, as the shop tolerance to be applied to the hole, as well as the shaft, or $H = S = N \times Z$.

6. Decide whether the shop tolerances are to be specified in the basic hole system or the basic shaft system, defined below:

"In a basic shaft system of fits, the basic diameter of the mating parts is the minimum limit of all shafts having that basic diameter, independent of the hole tolerance. Therefore, the hole tolerances are basic to plus, and variation in the character of the fit is obtained by varying the location of the maximum limit of the shaft.

In a basic shaft system of fits, the basic diameter of the mating parts is the maximum limit of all shafts having the basic diameter, independent of the shaft tolerance. Therefore, the shaft tolerances are basic to minus, and variation in the character of the fit is obtained by varying the location of the minimum limit of the hole."

The fits shown in diagrams *A* and *B*, Fig. 1 and *D*, *E* and *G*, Fig. 2, are specified in the basic hole system.

7.1 If the basic hole system is used, determine the location of the shop tolerances H and S as follows:

Hole Tolerance, H. Adopt the basic diameter of the mating parts as the minimum limit of the hole. Divide H into N zones of a width Z.

Shaft Tolerance, S. *Proceed as* indicated below, depending on whether the desired fit is a clearance, an interference, or a neutral fit.

(a) For a clearance fit, locate the minimum shaft limit a distance $(X + Z)$ *below* the basic diameter.

(b) For an interference fit, locate the minimum shaft limit a distance $(X + Z)$ *above* the basic diameter.

(c) For a neutral fit, adopt the basic diameter as the minimum shaft limit.

In every case divide the shaft tolerance S into N zones of width Z.

7.2 When the basic shaft system is used, determine the location of the shop tolerances S and H as follows:

Shaft Tolerance, S. Adopt the basic diameter of the mating parts as the maximum limit of the shaft. Divide S into N zones of width Z.

Hole Tolerance, H. Proceed as indicated below, depending on whether the desired fit is a clearance, an interference, or a neutral fit.

(a) For a clearance fit, locate the maximum hole limit a distance $(X + Z)$ *above* the basic diameter.

(b) For an interference fit, locate the maximum hole limit a distance $(X + Z)$ *below* the basic diameter.

(c) For a neutral fit, adopt the basic diameter as the maximum hole limit.

In every case divide the hole tolerance H into N zones width Z.

8. Number the tolerance zones of the shop tolerances H and S consecutively, from one limit to the other, and in the same direction for H and S.

9. In the assembly specifications, stipulate that only holes and shafts belonging to corresponding tolerance zones shall be mated.

Honing Oleo Cylinders for Aircraft

BY FRANK C. HUDSON

PRODUCTION of oleo cylinders for airplane landing gear has developed two very different methods of honing. The usual procedure is to rough and finish bore the cylinders, then ream so as to leave from 0.002 to 0.003 in. for honing. One well known and successful maker, however, uses a different method. He finish bores with a round-nose tool at a feed of about 20 to the inch.

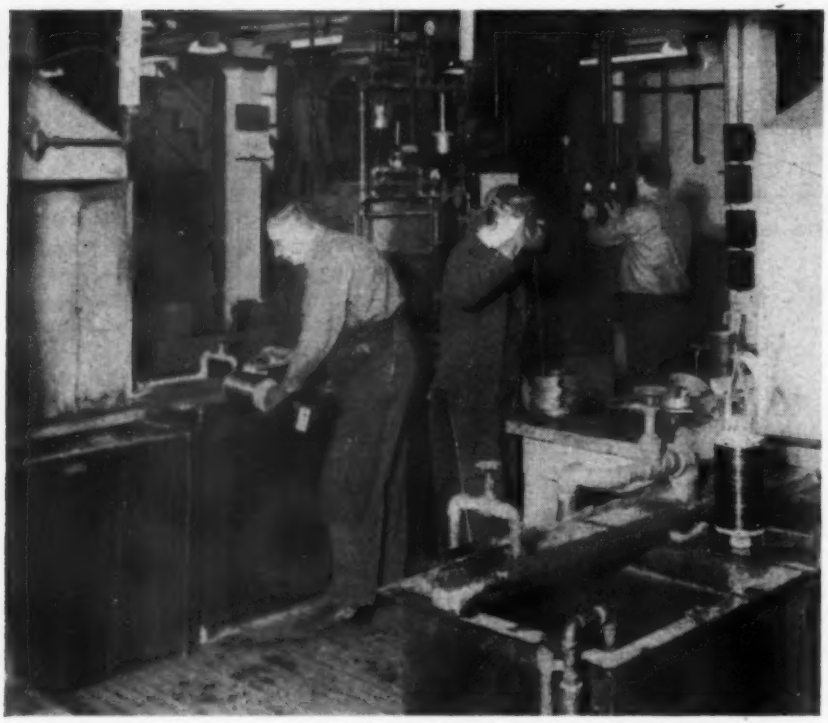
This leaves what is virtually a shallow thread with a round bottom, the tops of the thread being a little less than 0.010 in. above the rounded bottom. Then the cylinders are honed. The hone only contacts the tops of the "thread" at first, and as these contain little metal, the first few strokes of the hone take off a large percentage of the metal to be removed. It is only as the hone expands to nearly the finish diameter that it reaches the rounded bottoms of the threads. So, while the hone removes 0.020 in. from the diameter, the actual metal removed is not much more than where the cylinder is reamed before honing. This method has been found satisfactory and may have other applications. Certainly it smooths off the crests and produces a surface making a better bearing.

Another great difference in oleo strut making is whether the cylinder is bored from a drop forging or made from a tube. In the days before welding was considered safe by either Army or Navy, they demanded forgings so that the ears or lugs for link connection were integral with the cylinder. This demand was encouraged by the early makers of oleo struts who also made the drop forgings.

But with improvd welding practice and proof to those who wrote the specifications that welding could be depended upon, the use of tubes with the ears welded in place became permissible. The maintenance officer of a carrier assured me that he had never known a welded ear to fail. This should convince almost anyone aware of the punishment taken by the lending gear when a plane lands on an unstable carrier deck, and actually it is the only test required.

Chrome Plating of Piston Rings Increases Corrosion Resistance

BY D. M. SMITH, CHIEF ENGINEER
ST. LOUIS DIVISION, McQUAY-NORRIS MANUFACTURING COMPANY



Arbor loads of rings are dipped in an alkali cleaner, buffed and polished with pumice, swabbed and rinsed with cold water to prepare the face surfaces for plating

Controlled plating of the face surfaces of rings extends their life three to four times. The plated rings are subjected to thorough laboratory inspection

LIFE of top compression piston rings for gasoline engine cylinders has been increased three to four times by chrome plating the face surface. When plated properly, the rings have increased resistance to corrosion, abrasive wear, and to temperatures encountered in use. Scuffing of the top ring has been reduced materially.

Top compression rings for aircraft engines, tank engines and some automotive-type engines are being chrome plated in a modern department installed at the St. Louis Division of the McQuay-Norris Manufacturing Company. The plating process is carefully controlled to insure the application of a proper plating surface, including correct thickness. To effect the necessary control, a well equipped laboratory is maintained in the plating department.

The arbors on which rings are racked are approximately 20¾ in. long. The number of rings plated per arbor varies with the width of the ring. After degreasing, the rings are placed in a fixture for clamping between plates on the arbor. An air vibrator on the fixture assists in closing the clamp rings about the piston rings.

After the clamping rings have been drawn uniformly, the arbor nuts are pulled tight to press the end plates against the piston rings. The loaded arbor is placed between centers in a lathe and a stop-off material is poured through a hole in one of the arbor plates. The assembly is spun at about 250 r.p.m. for one minute to coat interior sur-

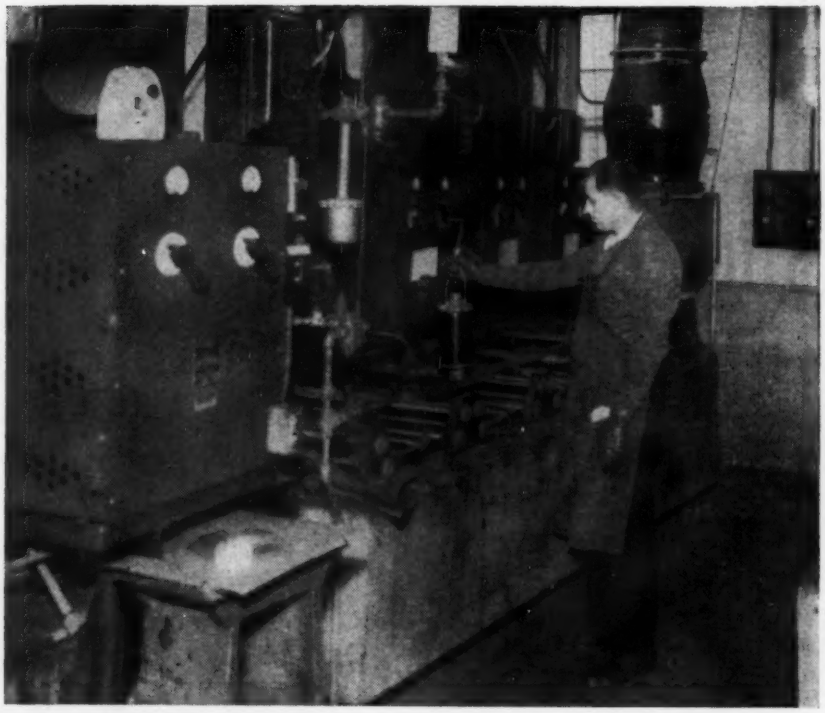
Plant Procedure in Chrome Plating Piston Rings

1. Degrease with the rings loose in baskets.
2. Rack on plating arbor.
3. Cover interior surfaces of rings with stop-off material.
4. Dip arbor load of rings in alkali cleaner.
5. Use pumice to buff and polish the face surfaces of the rings.
6. Swab with cold water and rinse to remove polishing compounds and pumice.
7. Reverse plate in chrome acid tank for 10 sec.
8. Plate in chrome acid tank for 4½ hr. at 3½ amp. per sq.in.
9. Reverse plate in individual chrome acid tank for 6 to 9 min. at 3½ amp. per sq.in.
10. Spray rinse with cold water.
11. Measure plate thickness at 12 positions with Magnegage.
12. Unrack and remove rings from stop-off shell.
13. Dip in cold water with rings loose in basket.
14. Dip in alkali cleaner with rings loose in basket.
15. Dip in hot water and allow to dry.
16. Dip in hot oil (180 F.)
17. Thorough inspection.
18. Ship to shop for final machining and inspection operations.

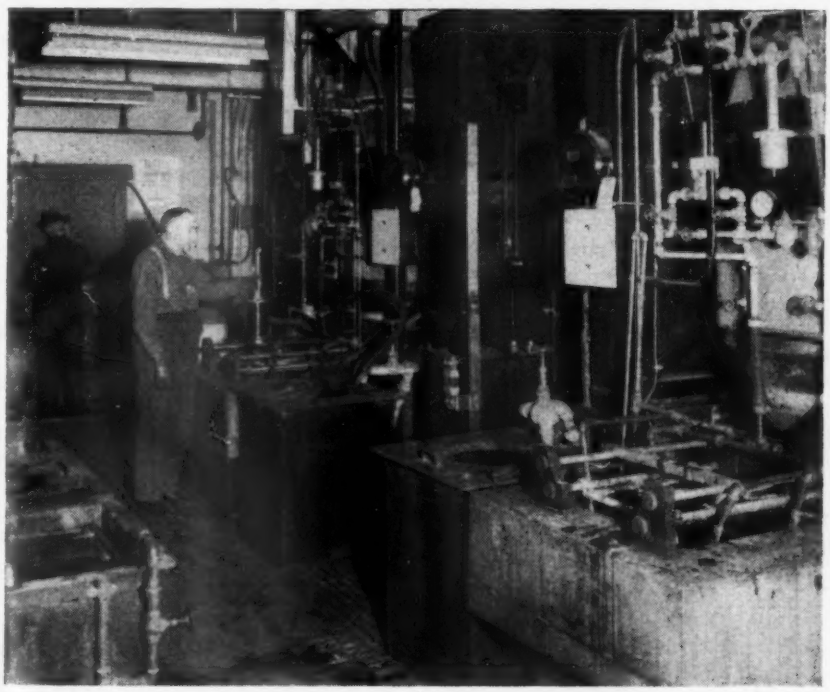
faces of the rings with stop-off. At the end of this time the stop-off is hard and the arbor load can be removed for subsequent operations.

The loaded arbor must be electrolytically clean before plating, and the face surfaces of the piston rings must be polished. After polishing, the assembly is swabbed and rinsed with cold water to remove the polishing compound and the pumice for the final polishing.

Chrome plating is done in three steps. First, the loaded arbor is suspended for 10 sec. in an individual chrome acid plating tank with reverse current. Next, the arbor load is suspended inside a perforated circular lead anode and the rings are plated for 4½-hr. at 3½ amp. per sq.in. The plating tanks used for this operation each have five positions for plating rings. At each of these positions there is a power unit made up of three General Electric 500-amp. copper-oxide rectifiers equipped with automatic current control to provide 1,500 amp. at 6 volts for plating a loaded arbor. The third plating operation consists of reverse plating in an individual chrome acid tank for 6 to 9 min. at 3½ amp. per sq.in. The plating solution is held at 122 F., within plus or minus 1 F., by a steam and cold water line in the bottom of the tank. Automatic Foxboro temperature controls are used for each tank. The solution is agitated constantly by compressed air at 75 lb. pressure. This air is passed through the bottom of the tanks by ½-in. pipes which have 5/64-in. diameter holes at 3½-in. intervals along the pipe lengths. Each of the plating tanks is a steel shell with brick lining and fumes are exhausted through slots at the top of each tank. Sheet steel hoods surround the tanks.



Each plating station in the tanks has its own bank of rectifiers for power supply and its own set of current controls. The arbor load of rings is suspended in a perforated circular lead anode while the solution is agitated constantly by air from a manifold pipe in the bottom of the tank



Loaded arbors are hung for 10 sec. in a reverse-current chrome acid plating tank before they are delivered to the plating tanks. Later the arbors are returned to the reverse-current tanks for a 6 to 9 min. plating cycle

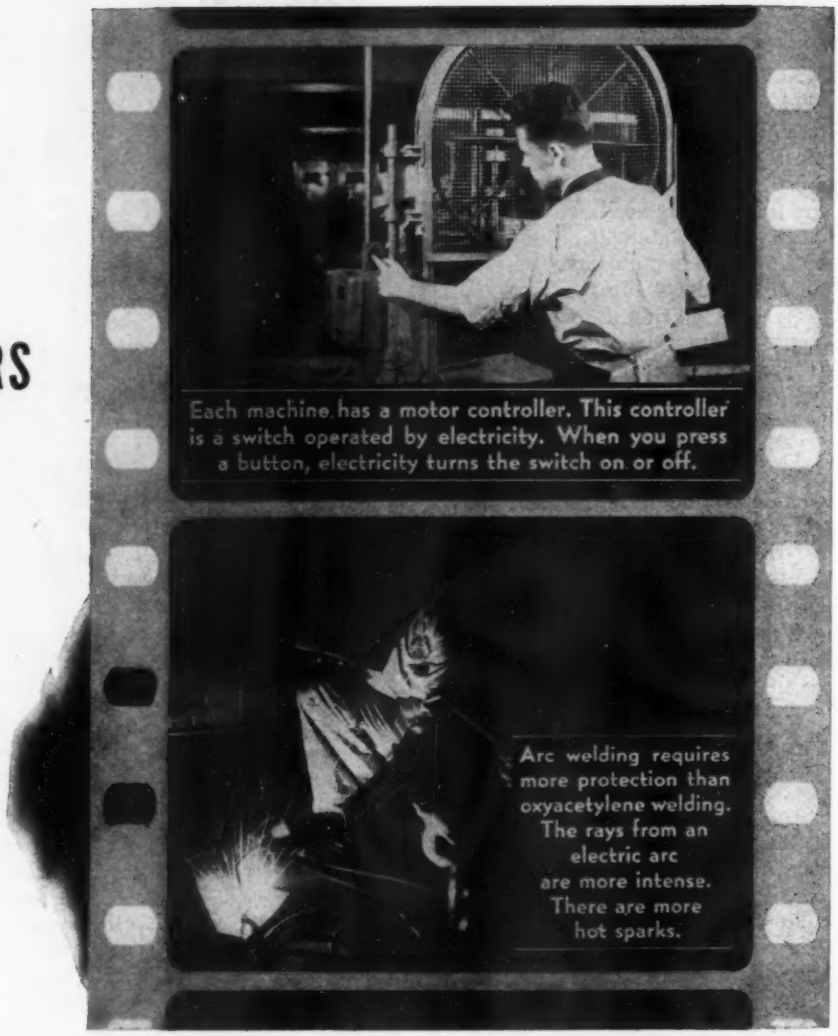
The chromic acid and sulphate content of the plating solutions are checked daily, while weekly analyses of sulphate, chromic acid, trivalent chrome, iron, chlorides boric acid and copper are made. It is important that the strength of each of the solutions be maintained accurately. Absorption of iron is watched carefully, as it reduces the throwing power of the plating solution and the thickness of the plate produced is thus reduced materially. The plate applied is held to 0.004 to 0.006 in. thickness, increasing the diameter of the rings from 0.008 to 0.012 in.

Each arbor load of rings is checked at twelve positions with an Aminco Magnegage to insure plating to the proper thickness. Four readings are taken 90 deg. apart around the arbor at locations one inch from each end and around the center of the arbor, making a total of twelve readings for each arbor load. Three times a week a microscopic thickness check is made to insure calibration of the magnet in the Magnegage.

Lettered Slidefilms

TEACH SHOP WORKERS SAFETY MEASURES

BY LYNE S. METCALFE


Each machine has a motor controller. This controller is a switch operated by electricity. When you press a button, electricity turns the switch on or off.
Arc welding requires more protection than oxyacetylene welding. The rays from an electric arc are more intense. There are more hot sparks.

The films condense much training information acquired under the stress of war, and serve to supplement other visual training programs

TRAINING FILMS ranging from instructional material for new employees to refresher courses for experienced operators have proved invaluable in speeding the tempo of production manpower to meet unprecedented demands for war materiel. The expanded field of visual training has become a part of industrial operations and further refinements will carry over into peacetime years.

Among the new innovations in visual training presentations is the use of a series of eight "discussion-type" slidefilms on the subject of "Basic Shop Safety." The films condense much of the material learned under the stress of war and convey it in simple formulas of visualization. These slidefilms deal specifically with the shop and its hazards and serve to augment many motion picture films prepared to help train machine shop workers in safe conduct and safety measures.

New visual teaching techniques become part of the slidefilm series. This type of slidefilm is a strip of 35 mm. safety motion picture film. The picture on each "frame" is a special photograph, drawing, chart diagram or other pictorial exhibit with lettering, labels and legends superimposed on the film to amplify visualization.

Each subject concludes with a review of the material presented and a set of test questions for the trainees. This presents the foreman or instructor with an opportunity to evaluate the trainees' response to the training courses. Each lesson is planned so that it is actually several lessons in one.

One film stresses the importance of working safely and deals with general safety in using tools and machinery, connecting portable electrical appliances, lifting heavy objects and using ladders.

Another emphasizes the conditions which lead to accidents, including the handling and storing of materials, disposal of scrap material, the fire hazards of wiping cloths, and the danger of protruding nails.

In dealing with emergencies, trainees are given instruction in the proper removal of clothing caught in a machine, location of emergency service, use of fire-fighting equipment, treatment for electric shock and similar handling of sudden mishaps.

A complete first aid course is included in one set of slides. Another set stresses the subject of eye protection, emphasizing the care and use of safety goggles, welding goggles, welding helmets and hand shields. Object lessons in the hazards attached to neglect in using the safety equipment are presented.

Another film provides enlightening information on power supply. Instruction is given on the starting and stopping of machines wired independently of each other, machines wired through a disconnect switch, use of motor controllers and emergency stop stations, machine speed changes, shifting V-belts and overhead belts.

Some of the courses might appear elementary, but this is an essential training factor when it is considered that many new employees have never had occasion to be around the machines and equipment they are destined to use.

The illustrations are typical frames of films used in the series developed by the Jam Handy Organization.

Bench Drill Press Spindles Driven Through Universal Joints

BY HARRY L. GIWOSKY, ASSISTANT SUPERINTENDENT OF TOOLING
WICHITA DIVISION, BOEING AIRPLANE COMPANY

Vertical motor supplies power for two-spindle unit. Records show that less maintenance is required than on gear types

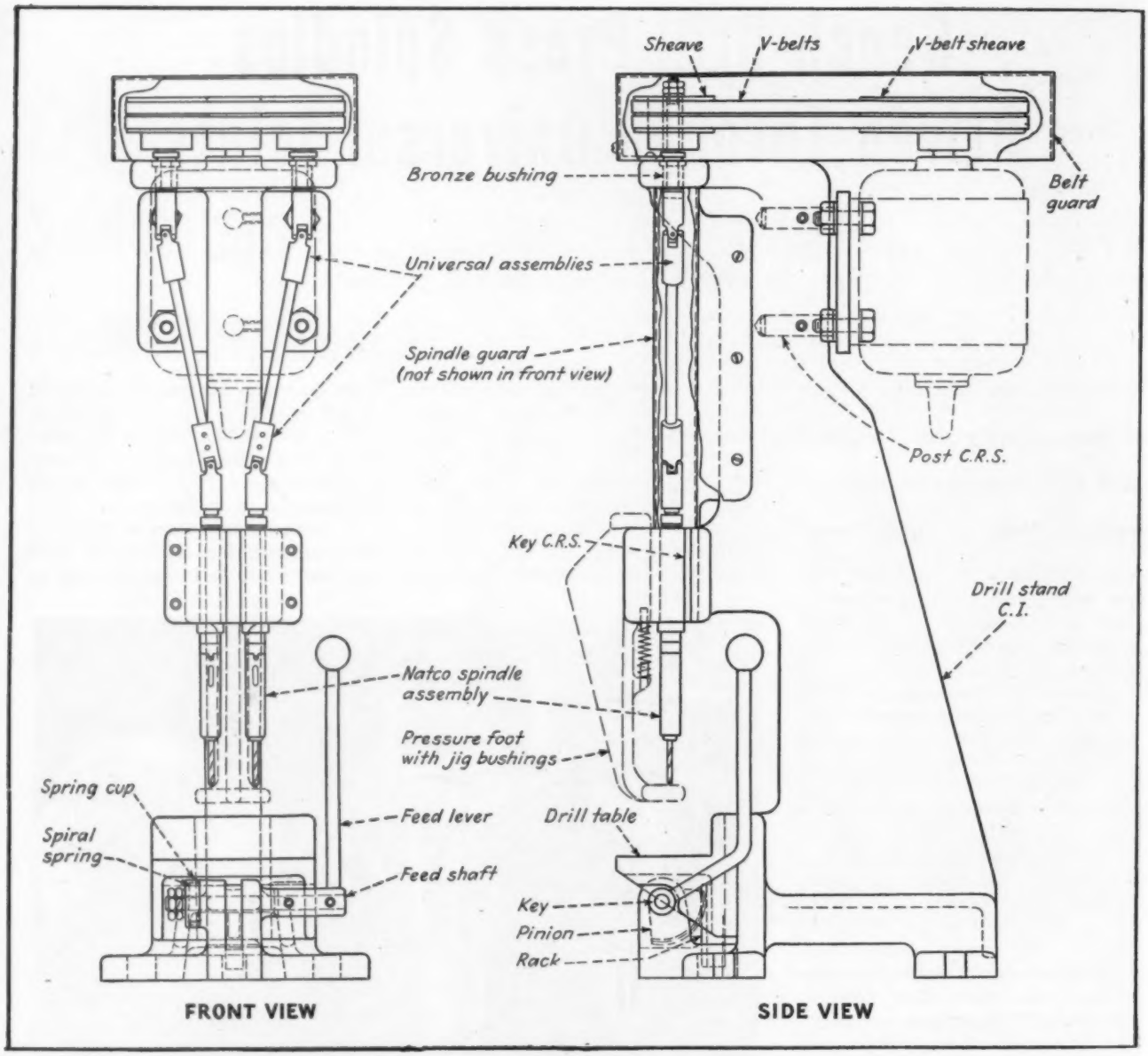
SMALL Natco ¾ in. universal-joint type spindles have been incorporated in the design of a small bench-type sensitive drill press made at the Wichita Division of the Boeing Airplane Company for drilling two small holes through aluminum-alloy filler blocks used in wing assemblies for the B-29 "Superfortress" bomber. Because thousands of these filler blocks are needed, a two-spindle unit is essential if the cost of the product is to be kept at a low figure. Experience has shown that less maintenance is required on this unit than would be necessary on the more conventional homemade gear driven multiple-spindle drill heads often used on single-point drill presses.

As shown in the accompanying illustrations, this bench-type drill press consists essentially of a cast iron stand or column on top of which is mounted a V-belt drive to the two spindle sheaves. The two Natco spindles are mounted in a fixed position in the front of this column over a drill table which is fed vertically by rack and pinion. The pinion is an 80-deg. sector of a gear having a 3-in. pitch diameter and 0.625-in. wide face. It is keyed to an operating shaft on the end of which is a long lever moved by hand to feed the table vertically. This pinion engages in a 3.12-in. long rack section bolted to a vertical surface on the underside of the drill table.

On the opposite end of the table feed shaft there is a 0.025 × ⅜ in. tempered steel spiral spring having ten turns in the free state. This spring is inclosed in a drawn sheet steel cup the open end of which is serrated to match serrations milled in the face of the base casting. Spring tension is adjusted by turning the cup from serration to serration radially around the shaft. This spring tends to hold the table of the drill press in its lower position. Vertical movement of the table to bring the work against the two drills is made against the pressure of this spring.

Mounted on the face of the spindle quill bearing block is a spring-loaded pressure foot which carries jig bushings in its lower end. This unit carries clamp bars to hold the work against the top of the drill table as the table is fed upward to

Designed for simultaneously drilling two small holes one inch apart in aluminum alloy filler blocks, this bench-type sensitive drill press has two Natco spindles driven at about 4,000 r.p.m. by a 1/3-hp. motor



TWO-SPINDLE BENCH DRILL DRIVES THROUGH UNIVERSALS

Details of the design of this small bench-type drill press can be varied to suit a wide range of work. Spindles are fixed in position; feed is obtained by moving the work table vertically through a rack and pinion mechanism. The spring-loaded pressure pad clamps the work on the table before the drills start to cut. Stop pins or nest plates on the table provide easy location of the work piece in relation with the drills

bring the work against the drills. When the pressure foot contacts the work, it moves upward with the drill table. A nest plate accurately locates the work pieces under the drills. When it is necessary, this nest plate can be varied to conform to different sizes and shapes of work pieces.

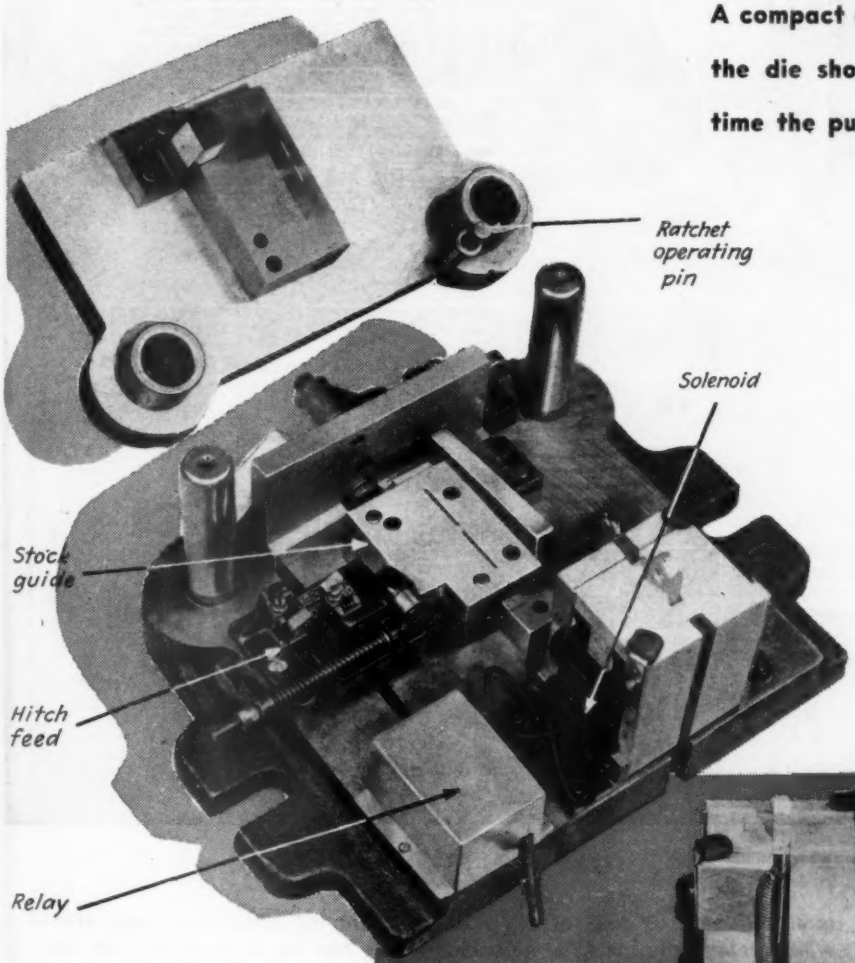
Two different types of these drill presses have been made up, one for drilling two No. 30 (0.1285 in.) holes at 1-in. center distance in a filler block, the other for drilling two No. 40 (0.0980 in.) holes having a center distance of 1.800-in. In each case, the spindles are mounted in fixed-center quill blocks. These blocks, of course, can be made up for almost any desired center distance within the limits of the spindle quill diameters and the size of the mounting surface on the drill stand. A more expensive design would be one having two quill bearing blocks adjustably mounted on the drill stand face.

Drive to the two drill spindles is from a 1/3 hp., 1,725 r.p.m. vertical motor mounted at the back of the drill stand on a plate which can be adjusted to give proper belt tension. This mounting plate has two posts which fit into drilled holes in the stand casting. Set-screws tightened against these posts hold the mounting plate at the desired distance from the back of the casting. Originally, the drive was designed to use two "A" V-belts. A revision of this design uses a single "A" V-belt drive, as experience has shown that a single belt is all that is needed. Sheet metal guards are fitted over the belt drive and in front of the spindles for the protection of the operator. The drill press can perform a wide range of work.

Change Gears Applied to Die Control Length of Slotted Parts

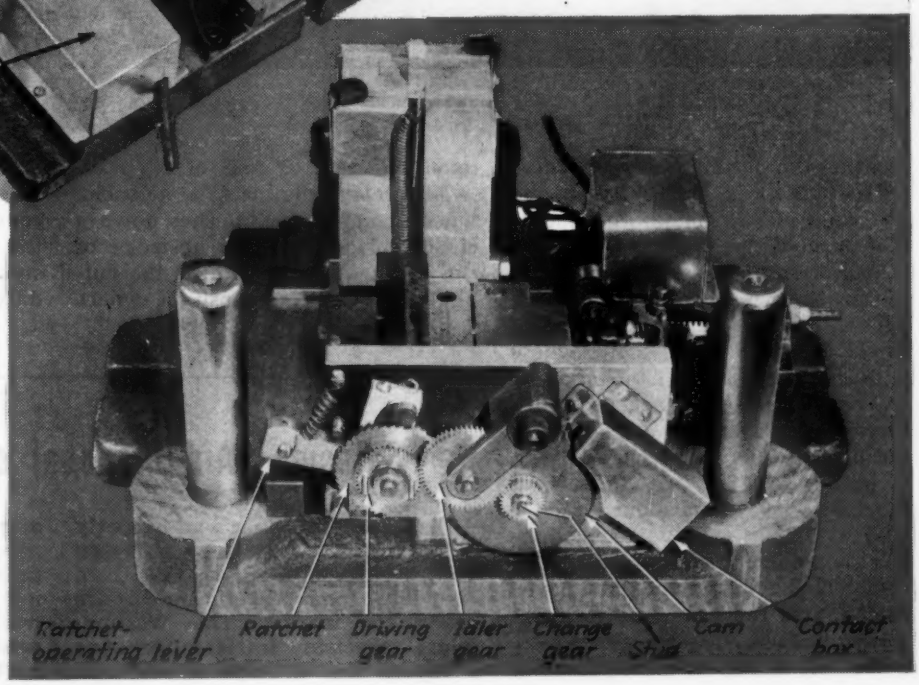
BY G. LETSCHE, SUPERINTENDENT, VULCAN TOOL COMPANY, DAYTON

A compact attachment applied to the front of the die shoe is operated by a ratchet each time the punch descends, controls the cut-off

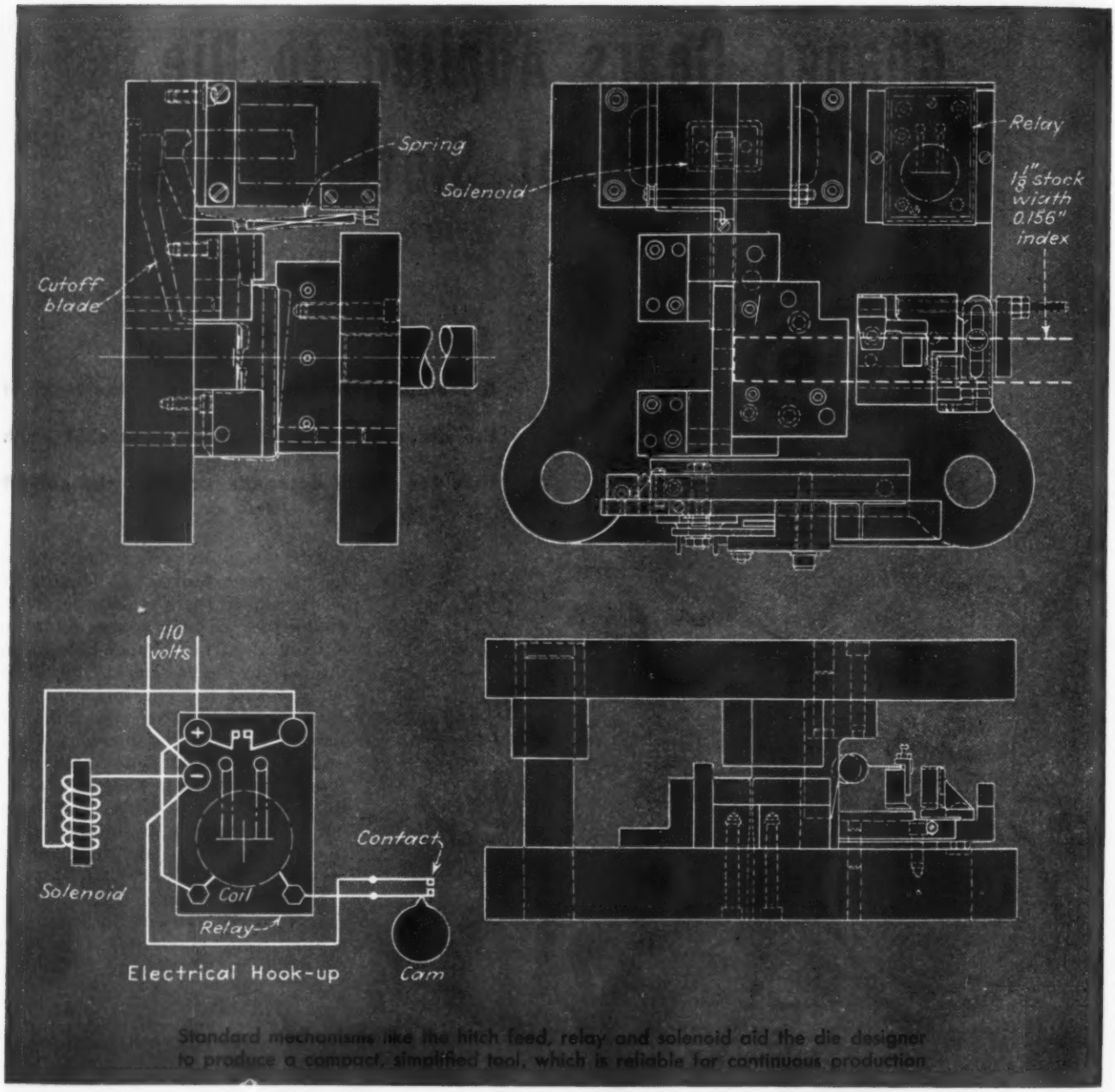


A DIE was built recently for a customer who required six lengths of parts, all of them incorporating a double row of slots spaced 0.156 in. on centers. The number of slots in the various pieces ranged from 17 to 84. So that the one tool could be used to make the six different lengths of part, the die was fitted with a change-gear indexing device, which trips a relay after the required number of slots have been cut. Thereupon, a push-down solenoid is energized, and the solenoid core actuates a cut-off blade.

Stock, 1⅛ in. wide, is fed into the die, from right to left, by means of a hitch feed. Guide keeps the strip flat and in alignment, as it ap-



Above—Completely automatic operation is a feature of this die for cutting off slotted parts in various lengths. Strip is advanced to the slotting punches by the hitch feed. Right—The change gear is selected with teeth equal in number to the slots in the piece, and when the ratchet revolves the gear one revolution, the cam closes the circuit of the electrically operated cut-off



Standard mechanisms like the hitch feed, relay and solenoid aid the die designer to produce a compact, simplified tool, which is reliable for continuous production

proaches the slotting punches. There are two of these punches, lying in the same plane, so that the double row of slots can be cut.

Each descent of the punch causes the spring-backed pin to press down a lever. This action causes a ratchet wheel to advance one tooth, where it is held by a pawl. Pinned to the ratchet wheel is a gear, which drives the selected change gear through an idler. The change gear, of 84, 51, 46, 36, 27 or 17 teeth as the case may be, is mounted on a stud. A fiber cam with one lobe is also mounted on the stud. One complete revolution of the driven gear causes the cam lobe to strike spring contacts. These contacts close a 110-volt circuit to a relay located upon the right at rear of die shoe.

The relay energizes a solenoid, whereupon the core pushes down a cut-off blade. At the upstroke of the press, a spring returns the cut-off blade to the up position, where it remains inoperative until the cam lobe has again revolved 360 deg. to contact the relay. Obliously it is the work of but a few moments to substitute the change gears when a different length of part is required.

Salesmen Aid Disposal of Surplus Goods

Disposal of surplus war property is providing traveling salesmen with a stock in trade to tide them over until their peacetime items are ready for market. The Westinghouse Electric & Manufacturing Company has a corps of salesmen disposing of materials no longer needed by the Army, Navy or Maritime Commission. Salesmen are aiding in clearing factory floors and warehouses of materials no longer needed for wartime manufacturing contracts.

Practical Ideas

War-Winning Suggestions appearing here were recognized as meritorious by the Board for Individual Awards, War Production Drive, and the Navy Employees' Suggestion Program. They are offered to industry to aid in war production

Indexing Milling Fixture Takes Standard Collets

BY ALEX S. ARNOTT

The indexing fixture illustrated in Fig. 1 was designed with the idea of adapting it to standard collet equipment with round, square or hexagonal holes to accommodate the various shapes of parts to be milled. The body of the fixture is made from a casting, with provision for fitting two keys as shown at *A*, held in place by the screws *B*. A hole is bored in the body and is made a running fit for sleeve *C*. Two holes are drilled and countersunk to act as ducts to carry oil to the sleeve, which must operate freely.

The hardened sleeve is a running fit in the body, being machined at one end, on the inside, to make a snug fit with the spacer *G*. A thread is turned to fit the nut *H* and a keyway is cut for a standard square key. The other end is bored and tapered for a standard lathe collet. A hole is made to fit the pin *J* which has a rectangular edge that fits into the keyway of the lathe collet, so that *C* and *K* will turn as a unit. The nut *H* draws the collet end of the sleeve against the casting face.

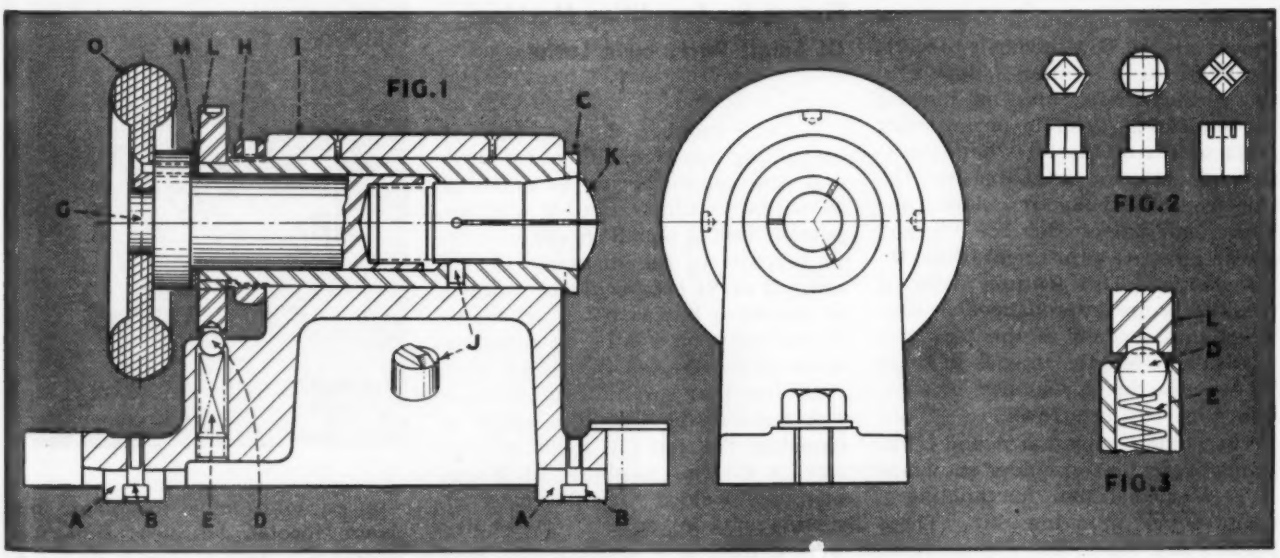
A four-position index plate *L* is shown in this fixture, but one with a greater or smaller number of indexing positions can be used. The plate is bored in the center as a running fit for the sleeve *C*, with a keyway for a standard square key which holds the plate to the sleeve.

A fiber washer is fitted over the spacer *M* and fits between the index and the large spacer to give a smooth running effect when the index is turned.

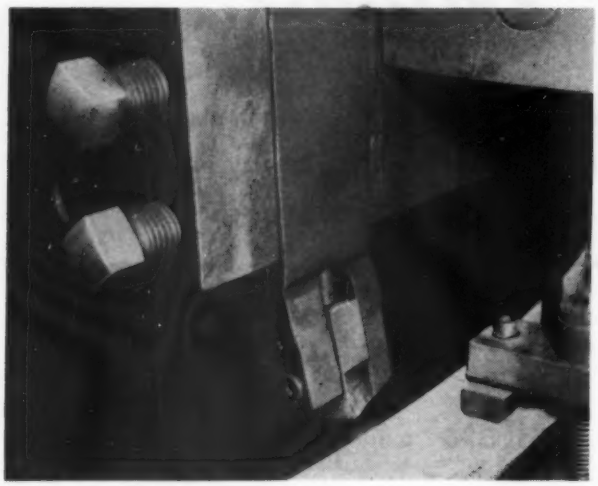
Three sample parts that require milling are shown in Fig. 2 and serve to illustrate how the fixture is used. Indexing is accomplished by making the required number of holes around the outside of the plate. These holes, the depth and diameter of which are shown in Fig. 3, are machined to suit the hardened ball detent *D*, which is held firmly against the taper by a spring *E*. A headless setscrew is used to regulate compression of the spring.

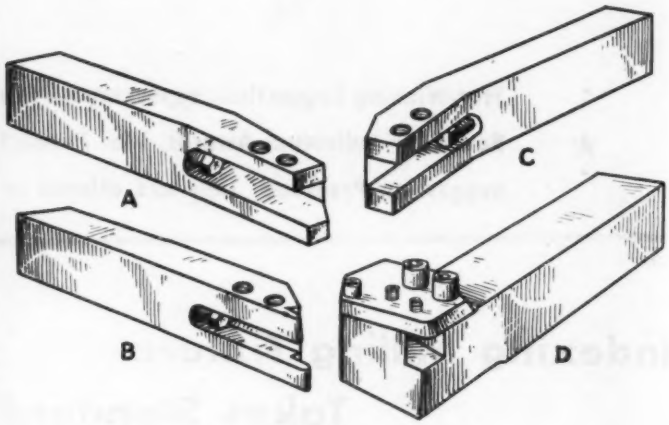
The large spacer *G* is bored on one end and threaded to suit the collet. The other end has a shoulder over which the hard black fiber handwheel *O* is fitted and held by six machine screws.

To index the fixture the wheel is turned in the direction against the collet threads, which forces the ball detent and the spring to back away, releasing the ball from the index hole. The index plate continues to revolve until it reaches the next



The indexing fixture sketched can be adapted to collets with round, square or hexagonal holes. Sample parts that require milling are at the upper right with the detailed section of the ball detent below





Open-slot holders of the type shown are extensively used for boring, turning and facing operations on boring mills. They have a number of advantages over the more conventional closed-slot type of holders. The holders shown at *A*, *B* and C usually are made from 2 × 3 in. stock 12 in. long. There is less tendency for the bit to bind in the holder slot with these tools than with the holder shown at *D*. In each of these holders a setscrew is for lengthwise adjustment of the bit to insure accurate positioning and provide end support

position, when the detent ball drops into the hole under spring pressure.

The sleeve is the only part to be changed to adapt the fixture to any size of work. The sizes of the collets may be selected from catalogs.

Simplified Toolholders Reduce Set-up and Tooling Time

BY THOMAS O. FORD

Considerable machine set-up time and tool bit replacement time is saved at Fisher Body's Grand Rapids Stamping Division plant on boring mill operations through the use of simplified tool bit holders of the type shown above. This holder is of sufficient size to give ample support to the carbide-tipped bit. One side of the bit slot is open to permit easy replacement of the bit when necessary. A setscrew extending into the slot from the body of holder provides end support for the bit and allows accurate adjustment of the bit for position. This feature makes it possible to use interchangeable bits, which are ground in the tool crib to the same length. In each of these holders the bit is clamped in position with two setscrews.

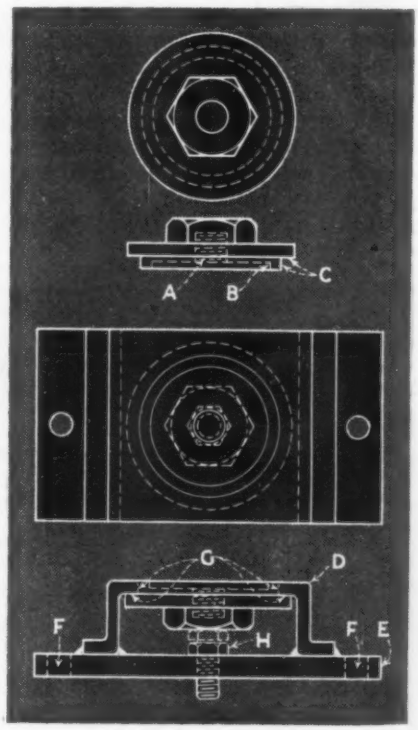
The holders shown at *A* and *C* are standard, while the holder shown at *B* is a special tool for holding a round-point grooving bit. These holders are much less expensive to manufacture than the covered holder shown at *D*, and they make it easier for the operator to replace bits when they become dull. Because the holder shown at *D* incloses the bit on all sides accurate positioning of the bit is more difficult than with the simpler holders. It has also been found through experience that the holder shown at *D* is apt to become coated with dust and small chips in the bit slot and this leads to binding of the bit in the slot when it is inserted. The holder illustrated is 12 in wide and 3 in deep. The slot is machined to hold a 1 × 1 in. bit 3 in long.

Fixture for Expediting Machining Of Small Parts on a Lathe

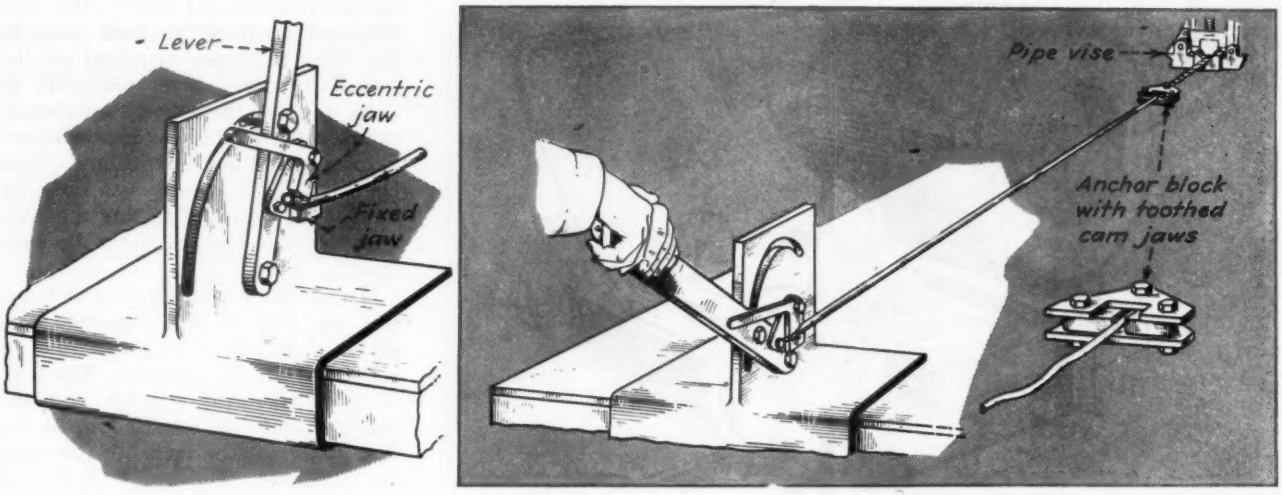
BY MICHAEL AXLER

A large number of caps required machining and threading, as at *A* and also counterboring as at *B*, as shown in the illustration. It was important that *A* and *B* should be true in relation to the diameter *C*. As only 12 or 24 caps could be worked at one time it was not practical to do the work on a lathe by clamping them in the jaws of the chuck, as it took too long to indicate them.

A fixture was therefore made to expedite the job. A sheet of soft steel, 4 × ¼ in., as shown at *D* was bent and welded to a flat piece of steel, 4 × ½ in., as at *E*. Two holes were drilled at *F* and the part was bolted to the faceplate of the lathe. The fixture was machined at *G* to take the caps. A screw *H* with locknut was inserted in the plate *E* to hold the workpiece. This brings the cap up against the machined surface *G*, where it is held tight.



Applied to a lathe faceplate, this fixture locates the piece from the reference surface C, avoids the need to indicate the piece during certain machining operations



A 20-foot length of tubing formerly required 20 min. to straighten with a hammer and blocks and was frequently damaged in the process. The job is now done in 3 min. with a jig and the tubing is straight and undamaged

Tubing Straightened in a Jig Without Flattening or Nicking

BY HARRY CARNEY
Permanente Metals Corporation, Richmond, Calif.

A method has been devised for speeding up the straightening of copper tubing which eliminates damage caused by the method used formerly. Tubing used in lubricating lines is delivered in coils. These coils were unwound on a bench and straightened by means of grooved wooden blocks, which were placed over the tubing and hammered to smooth out bends or kinks. This frequently caused flattening of the tubing in spots, sometimes nicks or burrs and even then the tubing was seldom entirely straight when the operation was completed.

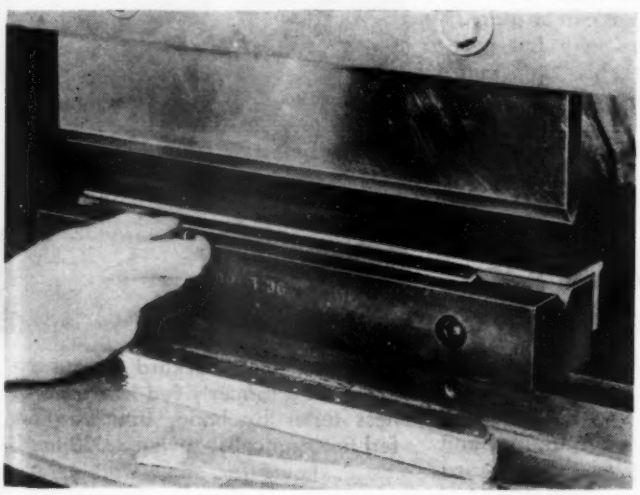
A jig was developed to replace the hammer and block method and has proved satisfactory. A measured length of tubing is now cut from a coil and roughly straightened. One end of the tubing is inserted in the anchor block of the jig and the jaws set. The other end is inserted between the fixed and eccentric jaws of the pull lever and the latter jaw is set by means of a lever. The cable or chain attached to the anchor block is then pulled, to tension the tubing and to position the pull lever in an upright position, after which the cable or chain is secured by clamping it in the vise. The operator then swings the pull lever downward. This stretches the tubing slightly and pulls out all kinks and results in the tubing being smooth and straight. A 20-foot length of tubing required 20 minutes to straighten with hammer and blocks, but the job is now done in three minutes with the jig, a saving of 22 man-man-hours per shift. *War Winning Suggestion from the Board for Individual Awards, War Production Drive.*

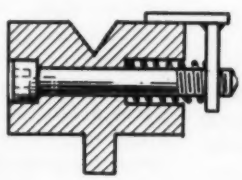
Guide Control Provides Time-Saving Adjustment for a Power Brake

BY GEORGE GILLESPIE,
Woodall Industries, Inc., Detroit

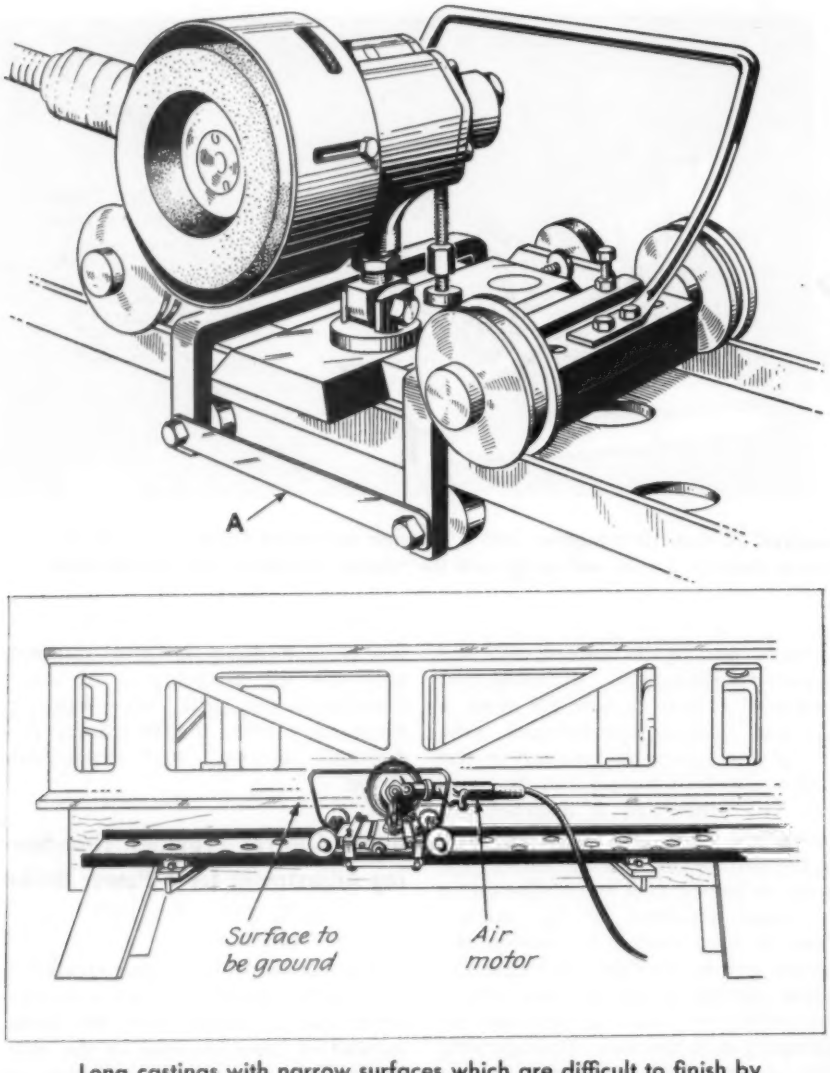
A guide control has been designed by which adjustments of a power brake can be made from the front instead of from the rear of the machine. This control unit consists of a special V-die designed so that enough body is available to hold a ½ in. socket-headed bolt with an inserted spring. A 90-deg. rack guide was made to fit into the back guide. The spring extends from the back of the pad and applies pressure to the back guide. A complete turn of the bolt moves the guide forward or backward 0.090 in., giving the operator micromatic control.

The device enables an operator to make adjustments of the guide from the front of the press, eliminating the necessity for going to the back of the press to make adjustments, saving considerable set-up time. *War Winning Suggestion from the Board for Individual Awards, War Production Drive.*





Addition of a guide control to a power brake gives the operator micromatic control of guide adjustments from the front of the machine, instead of it being necessary to make them from the rear



Long castings with narrow surfaces which are difficult to finish by grinding or hand filing are now finished at a considerable saving in time by a portable grinder mounted on a movable carriage

Track-Mounted Portable Grinder For Finishing Long Castings

BY J. HOHNSTEIN,
Marine Machinist Foreman,
Kaiser Company, Vancouver, Wash.

Grinding of long seating surfaces on reduction-gear lower cases is now being accomplished by a portable pneumatic grinder mounted on a carriage movable on a track. This set-up was designed to overcome the difficulty experienced previously because of the vertical position and narrow surfaces of the long castings to be ground. Hand filing was too slow and inaccurate for the purpose.

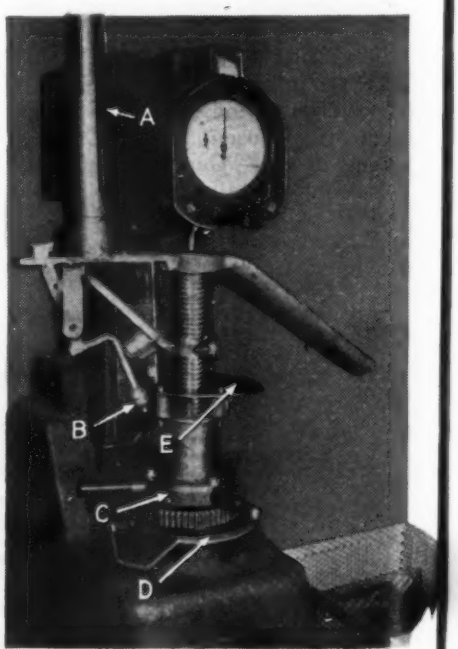
The machined track is attached by brackets to the work to obtain a positive location. A hold-down, *A*, equipped with rollers, keeps the carrier steady under the pressure of the cut. Feed of the slide-mounted grinder is controlled by a cross-travel screw. The unit can be quickly adapted to grinding in a flat position, saves considerable time compared with previous methods, insures a uniform job and close tolerances can be maintained. *War Winning Suggestion from the Board for Individual Awards, War Production Drive.*

Automatic Feed Cuts in Half Time for Hardness Testing

BY JOSEPH H. VANN, General Foreman,
Packard Motor Car Company

Automatic feed has been substituted for hand feed in handling and testing steel spacers used on Packard marine engines and has cut the time required formerly in half. Due to the close tolerance required on the camshaft rocker lever assembly of these engines, the spacers are closely checked with hardness specifications before grinding operations. This checking for hardness was done by hand on a standard testing machine and it was necessary to handle each spacer twice.

Mechanism for automatically feeding the spacers was designed and attached to the testing machine, as shown in the illustrations. The tube *A* is filled with spacers and the feeding lever *B* actuated until the first spacer of the lot is on the anvil for checking. The nut *C* is turned clockwise until the large and small needles on the dial are both at zero. The control lever *D* is then released and a reading taken as indicated by the large needle. The nut *C* is then turned to release the machine, which action also turns the cam *E*. The cam forces the pivoted lever *B* to the left, causing a slide feed to operate. This pushes the next spacer into testing position and ejects the tested piece into a chute leading to a box. Approximately 4,000 hours a year are saved for other work. *War Winning Suggestions from the Board for Individual Awards, War Production Drive.*



Spacers used in Packard marine engines were formerly fed into a hardness tester by hand, but are now fed automatically, saving 4,000 man-hours for other work

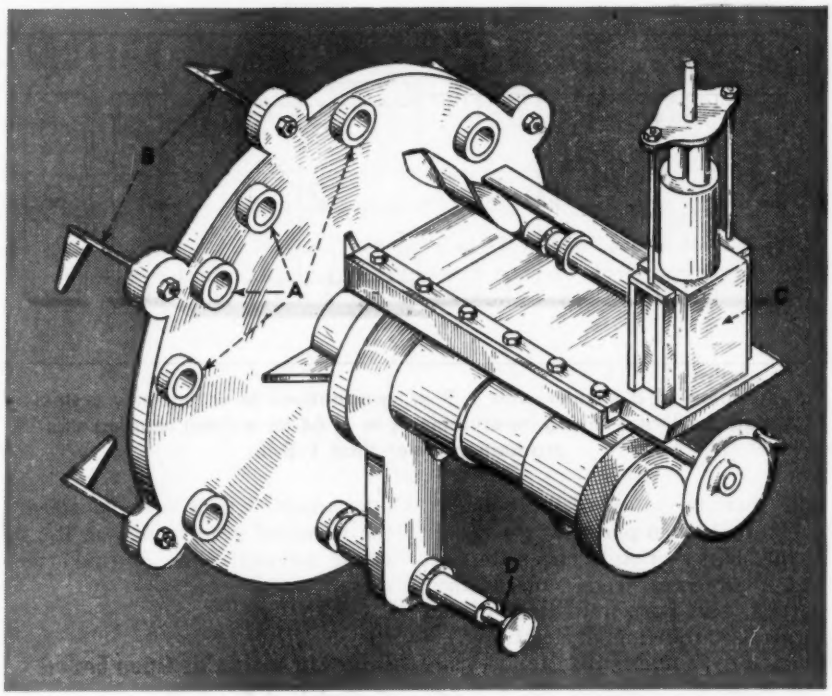
Bushing Plate With Indexing Drill Speeds Drilling of Bolt Circles

BY GABRIEL H. BALIK, Machinist Foreman, Oregon Shipbuilding Corporation

Laying out and drilling bolt circles by hand on large lineshaft flanges has been eliminated by the adoption of a master bushing plate. The method used formerly was a slow one, the layout being made from the back of the flange with the aid of many instruments. Drilling was done by using an "Old Man".

The bushing plate is fitted with ten evenly spaced drill bushings, as shown at *A* and is fastened to the lineshaft flanges at six points by clamps *B*. The bushing plate has a pinion-operated slide, on which the close-quarter air drill *C* is mounted. The drill is automatically positioned by the locating pin *D*. A pilot hole is first drilled by means of a small bushing, that fits inside the others.

With this device the necessity for a layout on these flanges is eliminated. The holes match up evenly with those on the mating shaft, supplied by a vendor. About 50 man-hours per ship are saved with this equipment. *War Winning Suggestion from the Board for Individual Awards, War Production Drive.*



Bolt circles on large lineshaft flanges were laid out by hand; this indexing drilling jig avoids difficulty in matching the hole locations with bolt holes in a mating flange

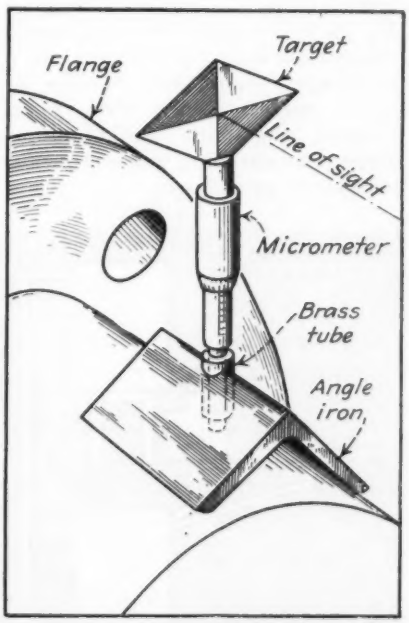
Jig Automatically Determines Correct Alignment of Shafting

BY ARTHUR B. NEILSEN AND HENRY MIDDLEMAN
Permanente Metals Corporation

A jig that automatically indicates elevation and lateral position of shafting without the use of wire and accompanying computations has been in satisfactory service for some time.

In aligning shafting a length of piano wire was generally stretched above it and a micrometer used to take height readings. These results were not always accurate and a reference table was required to make corrections for the sag in the wire. The tables did not show the difference in sag depending on the gage of the wire used, which often made determination of the true centerline of the shafting a difficult task.

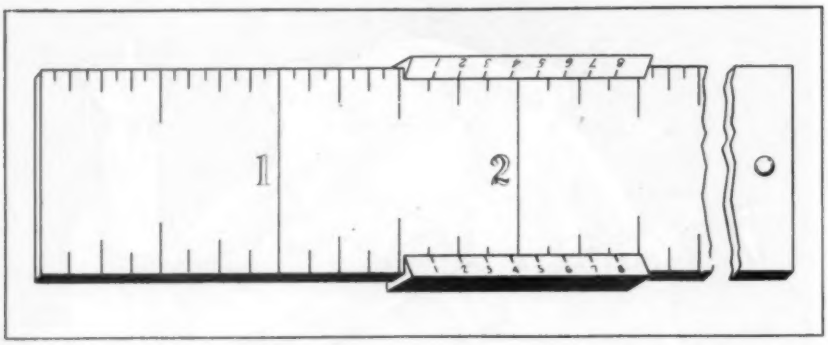
The new method, employing the jig, was used recently to determine the horizontal centerline and vertical elevation of a propeller shaft on a vessel at this yard. The jig consisted of a brass tube attached to the apex of a 2 × 2 × 10 in. angle iron. The brass tube has a micrometer bar extension fitted snugly into it. The toes of the angle iron are milled at 90 deg. to the center of the tube.



True elevation and lateral position of shafting can be determined easily by a micrometer jig. Troublesome problems incidental to the wire method of alignment are eliminated

The micrometer bar is 5 in. long and plus 4 in. for the micrometer head and 9½ in. for radius of the shaft, makes a total of 18½ in. above the center of the shaft. As the radius of the flange is 16½ in., the line of sight will clear the top of the flange by 2 in. A specially designed target is locked onto the micrometer head. A transit is then set up, the height of the instrument axis being 11 ft., 7 in., plus 18½ in. above the line, which indicates the true horizontal centerline. The target is set 18½ in. above the centerline of the coupling of the tailshaft and on a true horizontal centerline.

Sighting directly through the transit at the target on the tailshaft the line of sight is precisely 18½ in. above the true vertical centerline, with the target and micrometer set at 18½ in. The shaft is raised until the horizontal line of the target directly intersects the line of sight and then moved transversely until the vertical line of the target intersects the line of sight and the shaft is then directly on centerline and on true grade at that end. The jig is placed on the opposite end of the shaft, which is set similarly and the shaft



Addition of a vernier with 1/9 in. graduations to a machinist's steel scale facilitates taking measurements to 1/64 in. without reading scale graduations finer than 1/8 in.

will then be in correct alignment.

The jig is then placed at the center of the shaft section to check the sag. The micrometer head is raised until vertical and horizontal lines of the target cut the line of sight. A micrometer reading is then taken, usually 0.020 in., which is the average amount of sag. *War Winning Suggestion from the Board for Individual Awards, War Production Drive.*

Vernier for a Machinist's Steel Scale Simplifies Measuring

BY THOMAS TRAIL

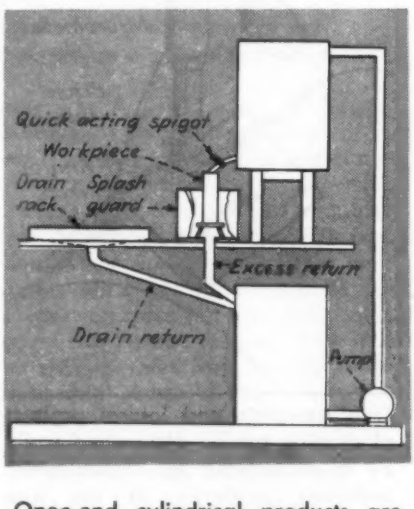
By addition of a vernier to a machinist's steel scale, fine measurements can be made without straining the eyes or resorting to a magnifying glass to read the divisions. The vernier is graduated in ninths of an inch. When a measurement is made with the ⅛ in. graduated edge of the scale, the inches, as well as the ½ in., ¼ in. and ⅛ in. graduations showing to the left of the vernier are noted. One numbered graduation line on the beveled edge of the vernier nearest the user will line up with, or nearly so, one of the ⅛ in. divisions on the scale. That will indicate the number of sixty-fourths to be added to the scale reading. The measurement shown would therefore be 2 in., plus ½ in., plus 2/64 in., a total of 2-17/32 in.

When measuring anything requiring nearly the full length of the scale, the vernier attachment should be turned end for end. Then the ⅛ in. graduated edge of the scale can be used by measuring from the end of the scale having the rivet in it to the nearest edge of the vernier attachment, which is the purpose of the reversed graduations on the opposite beveled edge of the attachment.

Painting Inside of Open-Ended Cylindrical Products

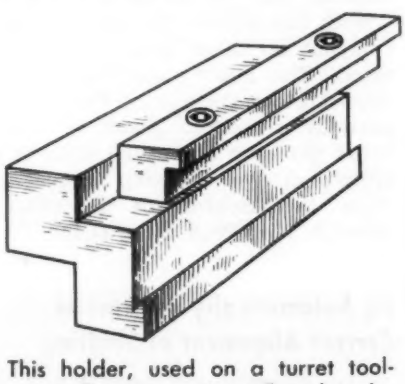
BY H. J. GURNEY,
Gorham Manufacturing Company

Painting the interior surfaces of pieces of steel tubing 10 in. long and 2½ in. in diameter has been accomplished successfully without use of automatic equipment. As the interior surfaces only were to be painted, the parts could not be dipped and spraying was undesirable because of paint losses.



Open-end cylindrical products are filled with paint, to within an inch of the top, which is afterward drained off, leaving a smooth finish. They are then inverted and the rundown of paint finishes the 1-in. top section

It was decided to set the pieces on end and fill them with paint to within an inch of the top. When the pieces were lifted from the table the paint ran down the inside surfaces into a container located below the table, which left the inside surface covered, except for one inch at the top. The pieces were then inverted on a drain rack and the rundown of paint covered the 1-in. portion that had not been covered previously. It was found that a 1-in. section was the maximum area that could be adequately covered by the rundown. The method proved satisfactory and economical, as the paint can be used repeatedly and an unskilled operator can easily meet production requirements. This toolholder has proved economical in the operations of a small shop where it is frequently necessary to use an engine lathe in regular production work.



This holder, used on a turret toolpost, allows a cutting-off tool to be set close to the chuck

Cutting-Off Toolholder Useful In Small Shop Production

BY DONALD R. TRYER

A cutting-off toolholder, which permits the use of a cutting-off tool close to the chuck, has been in service for some time on a turret toolpost. The top tie-down plate is held by two socket-head capscrews, which are loosened to remove the tool for sharpening or replacement without removing the entire block. This feature eliminates the necessity for realigning the tool every time it is replaced.

When machining the slot for the tool it should be slanted somewhat to allow for side clearance. The illustration represents a holder which was made for a ¾ in. cutting-off tool.

Simple Indexing of Any Angle—V

BY CHARLES HAVRANEK, FOREMAN, TOOL DESIGN DEPARTMENT, ARMA CORPORATION

HOLE CIRCLES FOR DECIMAL TURNS OF INDEX CRANK

N = Holes per Division. *D* = Appropriate Hole Circle

Turn	0		1		2		3		4		5		6		7		8		9	
	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D
.300	60	200									58	193	52	173	46	153	40	133	34	113
.301	31	103	28	93	25	83			22	73	60	199	57	189	54	179	51	169	48	159
.302	45	149			42	139	39	129			36	119					33	109	53	175
.303	20	66							27	89	61	201			58	191	24	79	55	181
.304			52	171			49	161					60	197			57	187		
.305	61	200	54	177			40	131	51	167			55	180	59	193	37	121		
.306	56	183	45	147			53	173			61	199	42	137			50	163	58	189
.307			39	127	47	153	55	179							52	169				
.308					49	159	41	133	62	201			54	175	46	149			59	191
.309							30	97	56	181	13	42	61	197	35	113			53	171
.310	62	200	40	129	58	187	27	87					50	161	55	177			60	193
.311			56	180			47	151	52	167	62	199			24	77	29	93	34	109
.312			54	173	58	189					45	144					56	179	51	163
.313	41	131	31	99			26	83	63	201			53	169	48	153			43	137
.314			38	121	60	191	55	175			50	159	28	89	62	197	34	108	57	181
.315	63	200	23	73			35	111	47	149	59	187					54	171		
.316	61	193			37	117	31	98	58	177	44	139	63	199	57	180	51	161	58	183
.317			39	123					53	167	60	189					41	129	55	173
.318					14	44			64	201	50	157	36	113	29	91			22	69
.319	52	163	45	141			38	119	61	191	54	169	31	97	47	147	63	197		
.320	64	200					49	153	33	103	58	181	42	131			60	187		
.321	26	81	35	109	62	193			9	28			64	199	46	143	28	87		
.322	57	177	48	149	58	180	39	121	59	183			20	62			61	189		
.323	52	161			32	99	43	133	65	201	11	34			56	173			23	71
.324	58	179	35	108			36	111			49	151	62	191	25	77	51	157	64	197
.325	65	200			53	163	27	83	55	169			42	126	57	175	29	89		
.326	59	181	15	46	61	187			63	193	48	147	65	199	33	101	50	153		
.327	52	159	35	107					37	113	56	171	19	58	58	177	59	180	60	183
.328	62	189			43	131	66	201	66	201	45	137			47	143	24	73	49	149
.329			26	79	53	161	55	167			57	173	59	179	30	91			65	197
.330	66	200	34	103			36	109					40	121	42	127	44	133	46	139
.331			50	151	52	157	54	163	58	175	62	187	66	199						
.332																				
.333							67	201												
.334																				
.335	67	200	64	191	60	179	56	167	54	161			50	149	48	143	46	137	44	131
.336			40	119			38	113					34	101	67	199	65	193	63	187
.337	61	181	59	175			57	169	55	163			53	157	51	151				
.338	24	71	47	139			69	201					64	189	21	62	62	183	61	180
.339	60	177			58	171			37	109			54	159			35	103	52	153
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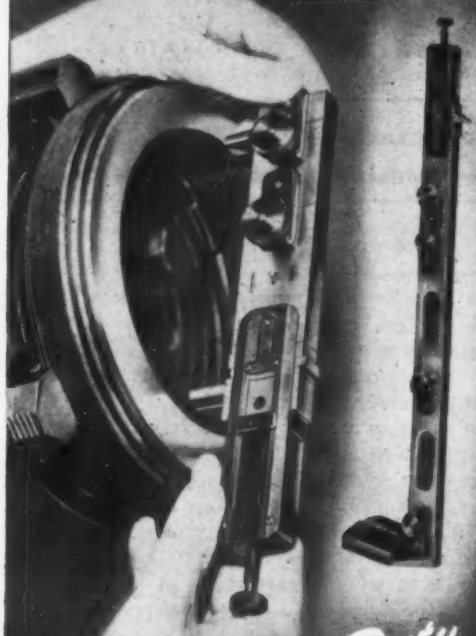
.342			13	38	64	187	51	149			25	73	62	181	49	143			60	175
.343			47	137	58	169	69	201	34	99	45	131	56	163	11	32			65	189
.344			32	93			63	183	62	180	41	119	61	177			30	87		
.345	69	200	38	113	68	197	48	139					66	191	28	81	37	107	55	159
.346					9	26			62	179	44	127			69	199	60	173	51	147
.347			67	193	50	144	58	167			49	141	65	187			56	161		
.348			63	181	70	201	31	89			23	66	61	175			45	129		
.349	52	149	59	169	66	189			29	83	36	103	43	123	64	183				

N = Holes per Division. *D* = Appropriate Hole Circle

Turn	0		1		2		3		4		5		6		7		8		9	
	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D
.350	70	200			69	197	62	177	48	137	34	97	27	77			67	191	60	171
.351	53	151	46	131					39	111			32	91	70	198	38	108	63	179
.352			25	71	56	159	68	193			49	139	61	173					66	187
.353					71	201	59	167	47	133	35	99	64	181	52	147				
.354	57	161			51	144	62	175	28	79	67	189	50	141			33	93		
.355	71	200	38	107	65	183	70	197	43	121			64	180	53	149	58	163	63	177
.356	68	191			26	73	31	87	36	101			51	143	61	171	71	199		
.357			10	28							69	193	54	151	49	137	39	109		
.358	29	81			72	201	67	187	62	173	57	159					47	131		
.359	42	117	65	181	37	103	60	167			55	153	32	89	50	139	68	189		
.360	72	200			58	161			71	197	53	147			66	183	35	97	61	169
.361			65	180			69	191	30	83			64	177	51	141	72	199		
.362	58	163	21	58	46	127	25	69	54	149			62	171	70	193	41	113		
.363			65	179	73	201							68	187						
.364			63	173	55	151	47	129			39	107			66	181	58	159		
.365	73	200	69	189			61	167			72	197	34	93	64	175			45	123
.366	56	153	67	183	26	71	37	101	59	161	70	191			66	180	73	199	62	169
.367	40	109	29	79	65	177	54	147			43	117					71	193		
.368			74	201					63	171					66	179	52	141	38	103
.369	69	187	55	149					58	157			17	46	44	119			64	173
.370	74	200	47	127	67	181			70	189	73	197	53	143			33	89	56	151
.371	23	62	59	159			62	167	65	175			68	183	42	113	74	199	45	121
.372			48	129	67	180	51	137			57	153			60	161	63	169	66	177
.373	72	193	75	201							31	83	34	91	37	99	40	107		
.374	49	131	55	147	61	163	70	187												
.375	75	200											74	197	71	189	59	157	53	141
.376			44	117	38	101	35	93					29	77			26	69	75	199
.377	72	191	66	175	63	167			60	159	57	151	54	143			68	180		
.378	48	127	76	201	73	193			42	111	67	177	39	103	64	169	25	66	61	161
.379			58	153			33	87					52	137	71	187			68	179
.380	76	200	65	171			27	71	62	163	43	113			75	197				
.381	72	189			69	181	53	139	37	97	66	173			50	131			76	199
.382	34	89	47	123	73	191			13	34	70	183			31	81			67	175
.383	54	141	77	201	64	167	69	180	74	193	51	133	61	159			38	99		
.384			58	151	68	177							65	169						
.385	77	200	62	161			42	109			69	170	59	153			76	197		
.386	66	171	39	101	73	189			17	44	63	163	46	119			70	181	77	199
.387			24	62			67	173	43	111	74	191	50	129			57	147		
.388	78	201	26	67			40	103	47	121	61	157	75	193					70	180
.389					65	167	58	149	44	113			30	77			69	177	62	159
.390	78	200	55	141	48	123			73	187	66	169			59	151	77	197		
.391	52	133	70	179	27	69	63	161			74	189	56	143			67	171	78	199
.392					60	153	71	181	31	79	42	107	64	163	75	191			11	28
.393	79	201			46	117	35	89	72	183					50	127	76	193	26	66
.394					54	137	69	175	71	180	43	109	58	147	15	38			62	157
.395	79	200	32	81	66	167	51	129			70	177	36	91	74	187	57	144	78	197
.396	59	149			63	159			67	169			71	179	48	121	75	189	52	131
.397	78	199			56	141	29	73	60	151	64	161	33	83	68	171	72	181	76	191
.398	80	201	41	103	45	113			49	123	53	133	57	143	61	153	69	173	77	193
.399																				

WEBBER'S
COMPLETE GAGE BLOCK SERVICE



Heavy Duty Gage Blocks

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Inspection Service

Replacement Blocks

Angle Gage Blocks

Webber Gage Company

12901 TRISKETT RD. • CLEVELAND 11, OHIO

Simple Indexing of Any Angle—VI

BY CHARLES HAVRANEK, FOREMAN, TOOL DESIGN DEPARTMENT, ARMA CORPORATION

HOLE CIRCLES FOR DECIMAL TURNS OF INDEX CRANK

N = Holes per Division. *D* = Appropriate Hole Circle

Turn	0		1		2		3		4		5		6		7		8		9	
	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D
.400	80	200																		
.401	79	197	76	187	67	167	66	157	59	147	55	137	51	127	47	117			43	107
.402	80	199	76	189	72	179	35	87	68	169	64	159	31	77	60	149	58	144	56	139
.403	81	201	52	129	77	191	73	181	48	119	69	171			65	161				
.404	61	151	78	193			57	141	74	183	36	89	70	173			17	42	66	163
.405	81	200	32	79	62	153			45	111			73	180	71	175	28	69	41	101
.406	54	133	80	197	13	32	13	32	76	187	50	123	37	91			72	177		
.407	81	199			68	167			77	189			64	157			73	179	82	201
.408					60	147	69	169	78	191	29	71	38	93			65	159	74	181
.409			18	44			79	193	70	171			34	83	59	144	75	183	66	161
.410	82	200	57	139			48	117	71	173			62	151					53	129
.411	67	163	74	180	81	197	58	141	72	175							77	187		
.412	82	199			54	131			73	177			58	143	76	189	45	109	83	201
.413	19	46			69	167			74	179	55	133	79	191			36	87		
.414	65	157	41	99	70	169			75	181	80	193	51	123						
.415	83	200	66	159	71	171	76	183					32	77	37	89	42	101	47	113
.416			67	161	82	197									75	180				
.417			83	199	68	163	56	139			43	103	38	91	33	79			84	201
.418	79	189	74	177			64	153	59	141			54	129			48	117	80	191
.419	75	179			70	167			26	62			60	143	81	193	55	131	76	181
.420	84	200	71	169	50	119	29	69	66	157			45	107			77	183		
.421			72	171			83	197	67	159	51	121			35	83	62	147	73	173
.422	46	109	84	199	76	180	66	161			79	187			41	97	63	149	85	201
.423			11	26			80	189	58	137			61	144	75	177	64	151		
.424			81	191	28	66					59	139	76	179	31	73	82	193		
.425	85	200	71	167	54	127	37	87	77	181	60	141			43	101			48	108
.426	72	169			78	183			84	197			61	143	67	157			73	171
.427	38	89	85	199	44	103			50	117	56	131			74	173	86	201		
.428													81	189						
.429									82	191	70	163					52	121	46	107
.430	86	200	40	93	77	179			34	79	65	151	62	144	59	137			53	123
.431	78	181	72	167	47	109			66	153	85	197			79	183	19	44	73	169
.432			86	199					48	111			61	141			87	201		
.433	42	97	81	187			78	180			75	173	62	143	36	83			82	189
.434	69	159	56	129			76	175					83	191			70	161		
.435	87	200	57	131	84	193			64	147	27	62	71	163	78	179			51	117
.436			58	133	65	149					79	181	31	71			38	87	45	103
.437	52	119	73	167	87	199					63	144					88	201	74	168
.438	60	137			39	89			32	73	82	187	75	171			61	139	79	180
.439	54	123			83	189	76	173	29	66	69	157	40	91	62	141	84	191		
.440	88	200					70	159	85	193			63	143	78	177			56	127
.441	71	161			15	34	79	179	49	111			87	197	72	163			57	129
.442	80	181			88	199					50	113	81	183	58	131	89	201		
.443	86	149	74	167			43	97					59	133	67	151	83	187		
.444									84	189										
.445	89	200	85	191			61	137	53	119	45	101	86	193	78	175	37	83	70	157
.446	62	139					78	177			71	159			88	197	63	141	80	179
.447					89	199			17	38	81	181	64	143	50	201	30	67	73	163
.448			82	183			39	87					48	107			57	127		
.449	66	147	78	167	84	187	31	69	40	89	49	109	58	129	85	189				

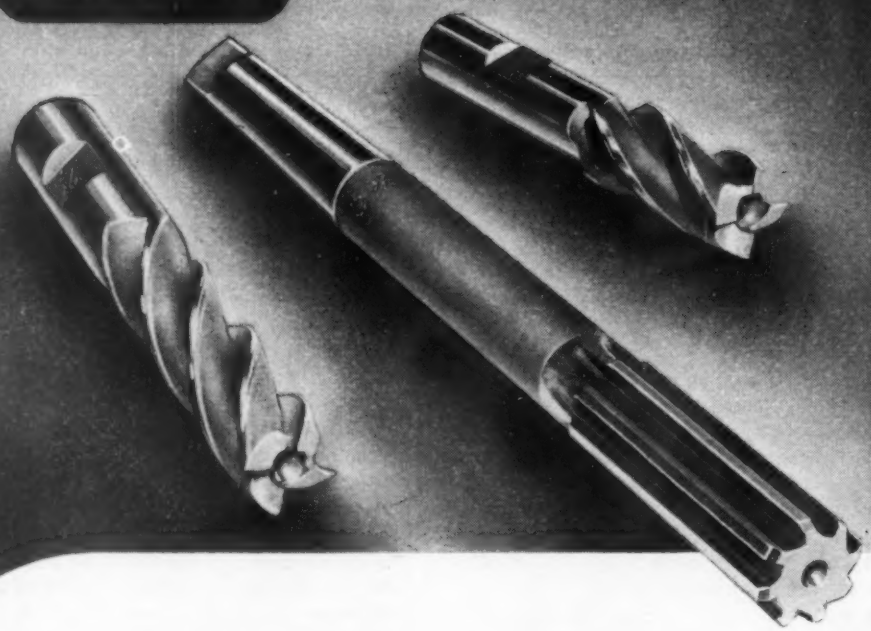
N = Holes per Division. *D* = Appropriate Hole Circle

Turn	0		1		2		3		4		5		6		7		8		9	
	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D
.450	90	200					86	191	59	131	50	111			87	193	78	173		
.451	69	153	60	133			51	113	78	175			28	62			89	197		
.452	80	177	33	73	90	199			19	42	81	179	62	137	91	201	72	159		
.453	53	117	82	181	63	139			73	161	83	183	44	97	49	108	54	119	64	141
.454	74	163									86	187					67	147		
.455	91	200	76	167			56	123	46	101	87	191	82	180	36	79			88	193
.456			78	171			47	103	68	149	21	46	79	173	58	127	90	197		
.457	69	151	80	175			91	199	59	129	70	153	81	177	92	201	38	83	49	107
.458	60	131	82	179			66	144					83	181	50	109				
.459	94	183	73	159	45	98					51	111	74	161			40	87	88	187
.460	92	200	75	163	52	113	87	189	64	139					41	89	86	187		
.461	65	141	89	193							78	169							91	197
.462	78	171			55	119	92	199	80	173			68	147	93	201	56	121	81	175
.463	80	108	69	149			82	177	57	123			70	151	83	179	32	69	45	97
.464			84	181			13	28			85	183	59	127			33	71		
.465	93	200	60	129	87	187	67	144	74	159	27	58	88	189			75	161		
.466	88	191			82	133	90	193							84	180				
.467	92	197	78	167	64	137	93	199	79	169	36	77	94	201	29	62	80	171	51	109
.468			66	141	81	173			37	79	67	143	82	175	15	32	15	32	83	177
.469	53	113	38	81			84	179	69	147			85	181	31	66	70	149	86	183
.470	94	200	71	151	76	161							88	187					89	189
.471			57	121	90	191	74	157			91	193			75	159			42	89
.472			93	197	85	180	94	199	77	163	43	91	95	201					61	129
.473			75	167			62	131	80	169					81	171				
.474	82	173			46	97	83	175			65	137	84	177	47	99	66	139	85	179
.475	95	200			86	181			87	183	68	143			49	103			89	187
.476					90	189					91	191	92	193			72	151		
.477			94	197			21	44	95	199	53	111	96	201	75	177	86	180	54	113
.478	76	159			77	161	22	46			78	163	56	117					34	71
.479	80	167			69	144	81	169			82	171	47	98	83	173				
.480	96	200			85	177	61	127	86	179	37	77	62	129	87	181			88	183
.481	38	79			64	133	90	187			91	189			92	191	93	193	40	83
.482	67	137			95	197	68	141	96	199	68	143	97	201			42	87		
.483	71	147			72	149	87	180	73	151	44	91			74	153			30	62
.484			76	157			77	159	78	161	47	97			79	163	32	66		
.485	97	200	49	101	82	169			83	171	84	173			85	175			86	177
.486	87	179	70	144	88	181	89	183			48	111	91	187	55	113	92	189	93	191
.487	94	193			57	117	96	197	97	199	98	201	59	121			60	123		
.488					62	127			63	129			64	131	65	133			88	180
.489			67	137	68	139			69	141	70	143					72	147	73	149
.490	98	200	74	151	75	153	77	157			78	159	78	159	79	161	80	163		
.491	82	167	83	169	84	171	85	173	86	175	87	177	88	179	89	181	90	183		
.492	92	187	93	189	95	193			98	199	99	201					34	69		
.493	35	71	71	144	36	73					38	77			39	79	40	81		
.494	41	83					43	87	89	180	45	91	46	93			48	97	49	99
.495	99	200	51	103			53	107	54	109	55	111	56	113	58	117	59	119	61	123
.496			64	129	66	133			69	139	71	143	74	149	76	153	78	157	81	163
.497	84	169	87	175	89	179	93	187	98	197	100	201								
.498																				
.499																				

(This table will be continued in an early issue)

AMPCO TOOLS

Engineers and Producers of Quality Cutting Tools Since 1917



Ampco Quality Tools Are Engineered and Built for the Fabrication of Alloyed and Heat-Treated Metal Parts

Descriptive Hammer Forged Circular Mailed Upon Request

AMPCO TWIST DRILL CO.

JACKSON, MICHIGAN U. S. A.

CHICAGO . DETROIT . CLEVELAND . PHILADELPHIA

Distributors in All Principal Cities

Gaging Business

Pressure Still Rising

Pressure on American industry continues to increase, as a result of the military's policy of placing all contracts covering known requirements for all of 1945. Since prime contractors are required to place their subcontracting orders on a similar basis, the full impact of the 1945 war program is being felt. What makes matters worse is that low inventories, arising out of last Fall's overoptimism engendered by official statements on the war's end, must be replenished to maintain the flow of increased industrial production. Moreover, lend-lease needs are rising, especially in view of the probable aid planned for France. The latest War Department program calls for a 1945 expenditure of $37,800,000,000, 18.9 percent higher than the 1944 deliveries. A 21.9 percent increase in ground force items is included in this program with emphasis on heavier-model tanks with greater firepower. Tank schedules have just been upped half a billion dollars, and the 1945 program will show a 70 percent gain over 1944.

Criticism of the Army's tank procurement policies may have been a factor in its decision to schedule some giant tanks. Critics scored the Army on not allowing for heavier tanks to cope with the giant German Royal Tiger tank. Army officials have stressed that their tank program was based upon an offensive war and not a defensive one.

Tool Orders Climbing

From an initial program of $40,000,000, WPB's pool order total for machine tools has slowly risen to $43,000,000, and more orders are still to be placed. That figure would have been higher by now, if it were not for the fact that WPB has had trouble placing some special machine tool orders. Regular makers of these tools and even possible subcontractors are booked solid. All other requirements by the military for machine tools will be met and on time.

The tool industry's year-end backlog of $260,000,000 was divided up as follows: military and rated orders $118,000,000, Russian orders $81,400,000, and unrated orders $60,600,000. The $118,000,000 total includes not only direct military orders for stepped-up ammunition programs, but also rated orders for replacement tools needed by war contractors.

January orders are expected to have been large, since that month witnessed placement of more rated orders, additional Russian business, and some unrated orders. Up to the 1944 year-end, $81,400,000 in Russian tool orders were unfilled, over $7,000,000 had been previously delivered, while some $4,500,000 more orders had been placed for metal-forming presses. Since the over-all total in the current Protocol year amounts to $120,000,000 in tool orders, this means that only some $27,000,000 in Russian orders remained to be placed, and most of these were probably ordered in January. Delivery time limit is September.

Unrated Orders Firm

An encouraging sign for tool builders is that the bulk of the unrated business placed in the optimistic months of late 1944 is still on the books and has not been cancelled. Most of these orders are for reconversion tools, yet, despite deferral of reconversion, industry is not changing its underlying plans. Only some $2,000,000 in unrated orders were cancelled in November.

WPB's new reconversion plan, prepared as a "stand-by program" at the request of Byrnes, is an encouraging factor for industry. There are conflicting rumors concerning the plan, with some reports that it is little more than the "Spot Authorization Plan" to be used as the VE-Day reconversion guide.

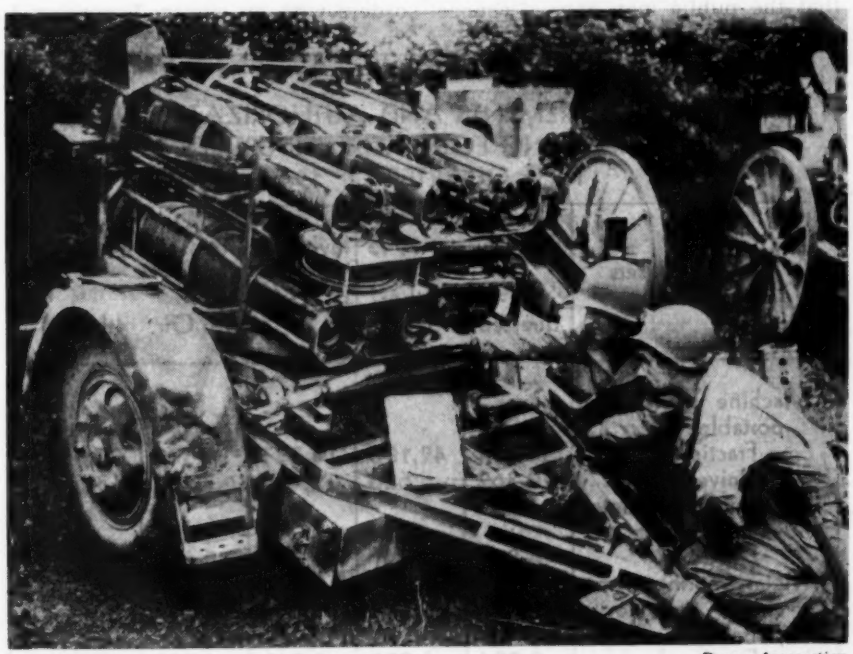
Manpower Outlook Brighter

December marked the only month in 1944 that the tool industry's labor force did not drop. Total employment rose from 55,000 in November to 56,000 in December. This was well below the January, 1944, figure of 75,600, but it was an encouraging note. However, Chicago tool builders are reported to have been hard hit by WMC restrictions, such as preventing hiring at the gate.

The auto industry is said to be in a good position on manpower with its requirements roughly balanced against its current labor supply. On the other hand, many subcontracting companies are running into labor shortages largely due to the fact that procurement agencies do not help them on manpower in the way they do prime contractors. This is regarded as one of the causes of sporadic component trouble.

Steel More Critical

As had been predicted, winter disruptions of steel production, combined with the general need for inventory replenishment, increased the seriousness of the steel situation. Second quarter allocations will be badly cut, particularly in non-military items. This will affect the ODT, the FEA, the War Food Administration, and even hit the warehouses.



—*Press Association*

German Rocket Gun—These American GI's are examining an abandoned Nazi rocket gun in northern France, and probably making some comparisons with American rocket equipment now being used on the Western Front

Owns Fontana, Kaiser Claims, in Reply to Big Steel's Bid for Plant

SAN FRANCISCO—Replying to an offer by U. S. Steel to lease or purchase the Fontana, California, steel plant operated by the Kaiser Company, Henry Kaiser claimed that he owned the Fontana plant, and that it is not for sale. In addition, Kaiser said he may be interested in bidding for the Geneva, Utah, plant owned by the government, and now being operated by Columbia Steel, a subsidiary of U. S. Steel. The U. S. Steel Corporation had already offered to take over the Geneva plant from the government, as well as, the Fontana plant.

Kaiser announced that he has employed engineers to survey the Geneva mill's relationship to postwar steel business on the Coast.

Ownership Claim Doubted

Outside the Kaiser group, there has been a tendency to take somewhat lightly Kaiser's previous claim of ownership of Fontana since the mill was built substantially from an RFC loan. In currently reiterating the ownership claim, Kaiser said sufficient "assets" to pay off about one-third of the RFC loan had been "allocated" to that agency. Unofficially, it is said the cash position of the Kaiser company is indefinite because final tax liability has not yet been determined. But it is reported that the assets referred to are in the form of cash, and over $30,000,000.

The Kaiser statement indicated that the public may have a chance in the future to participate in ownership of Kaiser enterprises, saying that the Kaiser company proposes to finance from such sources and in such manner as any corporation. On the score of physical assets with which it can operate a postwar steel business, the Kaiser company mentioned its ownership of 100 million tons of iron ore, in its Eagle Mountain deposit in Southern California, and its control of coal in Utah, now supplying Geneva.

Kaiser Needs Steel Source

In the past, certain observers have guessed that Kaiser was more interested in operating the Fontana plant, postwar, as a "private" source of material than he was of entering the steel business as such. Kaiser has announced his interest in the postwar housing field, and it is said that he is interested keenly in aviation. However, his postwar interests may be broader, perhaps including expectations of plenty of shipbuilding work on the coast.

Nevertheless, the Big Steel-Kaiser controversy has heightened interest in the western steel situation. A committee of the Los Angeles Chamber of Commerce, including some prominent industrialists, is investigating the matter, recently holding a two-day meeting in Salt Lake City. The San Francisco Chamber of Commerce has also formed an iron and steel section.

WPB Study of Inventories and Output Indicates Motor Bottleneck Unlikely

WASHINGTON—Future production bottlenecks in machinery and equipment arising out of motor shortages appear unlikely as a result of new WPB controls and attendant compilation of necessary data on motor requirements, inventory, production, and authorizations. WPB's data based on needs of large users of fractional, universal and shaded pole type motors (those requiring more than 450 motors monthly) revealed that total applications for the first quarter of 1945 at around 1,500,000 were some 250,000 motors less than the industry's capacity.

However, WPB screened these orders with an eye on December 1, 1944, inventories of 646,000 motors, and authorized purchases of 1,098,473 motors for the first quarter of 1945. This was some 20 percent above the 908,222 motors used in the fourth quarter of 1944.

Some Special Shortages

Aside from the over-all favorable situation, it is admitted that shortages exist in some special motor sizes. This accounts for WPB's close control over producers, apart from the basic need for correcting maldistribution among users.

As indicated in the accompanying table, manufacturers of metal-working equipment did not fare too badly in their first quarter authorizations. Machine tool builders requested 54,354 fractional horsepower motors and 20,362 universal motors, but were authorized to receive 42,198 fractional and 5,620 universal motors. On the other hand, builders of machine attachments, whose motor inventory was dangerously low, were authorized to purchase the entire 4,841 motors requested. Makers of portable tools and metal-working machines were authorized to purchase 6,852 fractional motors and 88,133 universal motors, as compared with the 8,804 and 92,230, respectively, requested. Except in the case of universal motors for machine tool builders, the difference between requests and authorizations was more than made up by inventories.

The distribution of commercial electric motors were placed under control by WPB Limitation Order L-341, dated December 4, 1944, requiring all purchasers of more than 450 fractional horsepower motors per month to file reports on their use, inventories, and requirements to meet authorized schedules.

MOTOR REQUIREMENTS AND AUTHORIZATION FOR METAL-WORKING EQUIPMENT INDUSTRIES FOR FIRST QUARTER OF 1945

Group of Users & Motor Type	First Quarter 1945		Inventory as of 12/1/44	Actual 1944 Usage	
	Requested	Authorized		3rd Qtr.	4th Qtr.
Machine Tools, non-portable					
Fractional	54,354	42,198	14,327	37,500	37,054
Universal	20,362	5,620	2,416	3,466	3,598
Attachments for metal-working equip.					
Fractional	4,841	4,841	365	5,669	3,499
Metal-working machines and tools, portable					
Fractional	8,804	6,852	2,940	4,895	5,930
Universal	92,230	88,133	68,689	76,720	81,674
TOTALS	180,591	147,644	88,737	128,250	131,755

Inside Detroit

Reconversion Setback Big

The German break-through set back the allied winter offensive about two months but it set back the automotive industry much farther than that. In fact, it has made the word "reconversion" the most hated word in the lexicon, a forbidden phrase in this section of the country.

Conservatively, the Nazi counter-offensive has set back new cars from six to nine months. Whereas, it was expected in high quarters that the 194X car would be rolling off production lines in sizeable quantities by this Fall and a small start was set as far ahead as this May, no one will even venture a guess as to when the resumption of production can be expected now. Popular opinion is that none will be manufactured in 1945.

George Romney, managing director of the Automotive Council for War Production who keeps his fingers on the pulse of the industry, recently voiced this bit of pessimism: "New car production will not start for many a day after VE-Day."

Romney, even before this gloomy statement, told this writer that all the gains that had been made last year for pre-reconversion planning had been lost.

Some Preparation Helped

Balancing this, somewhat, is the feeling that during the temporary lull in war production, when the feeling ran high that Germany was about to be finished off, many of the companies lined up facilities which will cut down the time when they may resume production of cars. Packard, for instance, won the right to replace its parts making equipment and this will form a skeleton production line once it gets the go ahead signal.

The freeing of some technicians, with the consent of the War Manpower Commission, even for a short time advanced some planning. Each little step, while wiped out by the sudden German counter-blows, gained something for the industry which has not been altogether erased.

But none denies that the major steps, won so bitterly, have been wiped out. The services, which fought them and gave in so grudgingly, will not let go of their regained power. They were overridden once but the next time it will be harder than ever to convince them.

War Business Expands

New war contracts continue to flow into Detroit factories. The latest, reflecting increases in demand for the B-29 super-fortresses, add $136,000,000 to the already huge total. This means that since Jan. 1, plants in this area have received three-quarters of a billion in additional work.

Fisher Body and Hudson were the chief beneficiaries of the new contracts. Both are for B-29 component parts.

Fisher Body's was for $79,235,000 and Hudson's for $29,697,000. Fisher will sub-contract about 30 percent of the work and Hudson about 20 percent. This will be a boon for some of the small shops which have been marking time since the first of the year while the new contracts were being approved.

Manpower Balanced

Strange feature of the Detroit area is that despite the influx of new orders of sizeable proportions, the pay rolls are staying on an even keel. In fact, last month there was a slight drop reported by the Board of Commerce's industrial survey.

Manpower here is now said to be about balanced. Even the War Manpower Commission is about ready to admit this. Their last figures showed only 2,800 male workers needed for critical industries.

MACHINERY CURB DOES NOT AFFECT MACHINE TOOLS

WASHINGTON—The War Production Board's recent halt in production and delivery of machinery for civilian production use, as had been permitted under Priority Regulation 24, does not affect machine tools. The types of machinery affected include: elevators and escalators, general industrial equipment, conveying machinery, power transmission equipment, electric motors and generators, printing trades machinery, electric motor controllers, resistance welding machinery, and logging, lumber and wood products machinery and equipment.

Although tool builders have $60,000,000 in unrated orders on their books, pressure for military orders and rated essential orders means that very little in unrated tools will be delivered.

Tool Advisory Committee

Two Detroiters are on the newly formed cemented carbide cutting tool industry advisory committee. They are W. G. Robbins of the Carboloy Co., Inc., and F. H. Willey of Willey's Carbide Tool Co.

The industry is about a month behind on deliveries of tools for shell cores and increased production is sought.

Romney Scores Unions

In a statement to the Senate War Investigating Committee, Mr. Romney accused union representatives, officials, shop stewards, and a minority group of workers with "thwarting the desire of the majority" by preventing them from doing more work and creating disorder and confusion in the automobile plants. Mr. Romney stated, "The UAW-CIO's black record of strikes, stoppages and slowdowns during the war is well known and severely deplored. Not so well known, however, is the vicious infighting and groin blows that labor leaders like George F. Addes (secretary-treasurer of the CIO-United Automobile Workers) are delivering continually to industry and the war effort by trying to usurp management's functions and responsibility.

Mr. Romney pointed out that in spite of the UAW's no-strike pledge, the record shows that that war production is being interrupted by five times as many strikes as the industry had before the war, not to mention constant violations of contracts with individual concerns. He said that in 1944 there were 1,045 recorded strikes and work stoppages in 500 automobile plants, and at least 43 percent of the cases involved plant discipline and productivity. Of man hours lost due to stoppages, 82.3 percent involved disciplinary cases in 1944, as compared with 4.4 percent in 1940.

Union Reply Blasted

In answer to this statement, George F. Addes accused the Automotive Council for War Production of "mud-slinging," saying that cost-plus contracts were responsible for inefficient plant conditions, and that the union had to push management into converting to war production. Mr. Romney replied that the unions were "hitting below the belt" while they were shouting "foul." He added that there were no cost-plus contracts in the automobile industry. As for conversion, Romney said that the UAW had protested on July 20, 1941, the government curb on auto output.

Association Study Shows Tool, Die Industry Hard-pressed by Taxes

CLEVELAND — The newly-organized tool and die industry has started a campaign to obtain relief from excessive taxes and renegotiation which it contends are grossly unfair to the industry by virtue of the abnormal character of its business in the 1936-39 base period years. For example, returns from a questionnaire indicates that earnings of the tool and die shops during the tax base period were off 61 points from the 1926-1929 average in the face of an eight point rise in sales, whereas earnings of business in general were off only 18 percent on a 12 percent smaller sales total.

In a study based upon statistics gathered from among the 4,000 to 6,000 shops in the country, the National Tool & Die Manufacturing Association and the Tool & Die Institute of Chicago jointly have prepared data to show that the base years of 1936-39 constituted a depression for the tool and die shops almost as deep as that of 1932, contrary to the general trend of business. The study was made by W. R. White, Jr., vice president of the Midwestern Tool Company, Chicago, and Stuart H. Sinclair, sales manager of the Federal Tool Co., Chicago.

9.9 Percent Yardstick

The association found that the average profit rate attained during 1926-29 was 9.9 percent, and members are advised to apply this yardstick in analyses of their business over past years to select a more favorable base period, then to appeal to the Treasury Department for the relief provided by statute in the event of such inequities.

Noting that the special tool and die industry can operate at a loss or small profit margin even during periods of relatively good business for general industry, the counsel is also given to avoid any spending on the theory that the "government is paying 80 cents on the dollar." The accumulated 20 cents might be the margin required for postwar operation.

Postwar Prospects Gloomy

In appraising the postwar prospects of the contract shops, the study notes that the peak of the war tooling program is passed and the recession already started in the industry. After the general reconversion program at the war's end estimated to require a year and a half, the likelihood is advanced that there will be no appreciable tool demand.

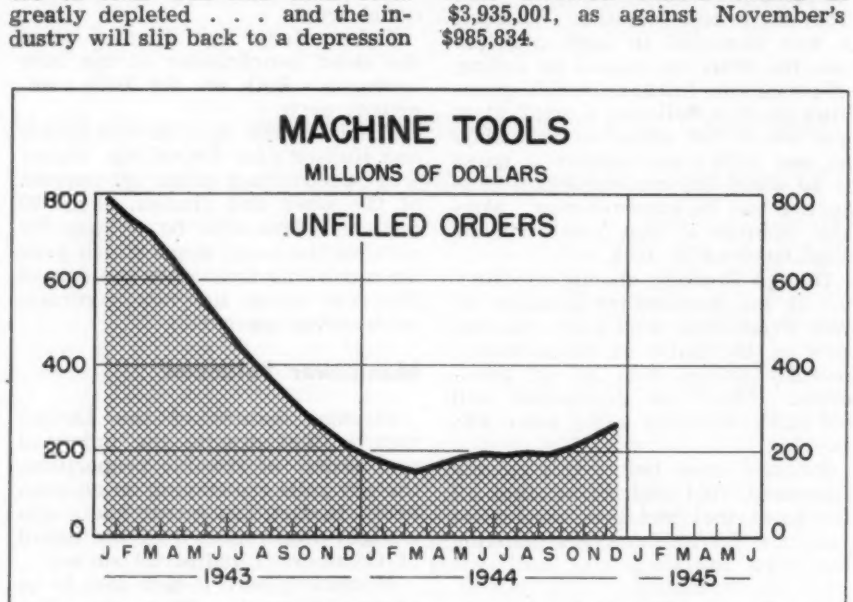
It is considered possible that the greatest part of the reconversion tooling program will be handled in the expanded tool rooms of the large manufacturing plants. In any event, demand cannot possibly employ the entire capacity of war-magnified facilities of the industry.

Pointing out that unlike other industries, the tool and die makers are not accumulating any unfilled demand, the association study makes this gloomy prediction:

"The amount of tool demand will be spread so thinly over the industry that the majority of the producers of tools will find their sales greatly depleted . . . and the industry will slip back to a depression level. The prices on all questions will have to be low enough to attract sufficient business to pay costs of direct labor, material and other out-of-pocket expenses, if possible, for the purpose of maintaining key personnel. Officers' and administrative salaries will again be cut; the possibility of a reasonable profit will be a thing of the past."

Truck Bookings Quadrupled

CHICAGO—December, 1944, bookings of electric industrial trucks and tractors were four times the value for November, according to The Electric Industrial Truck Association. December bookings of 683 units involved chassis valued at $3,935,001, as against November's $985,834.



Mounting Tool Backlog—Tool builders started 1945 with a $260,501,000 backlog. Lack of manpower and component bottlenecks kept December's shipments at $36,782,000, only a slight gain from November's $36,277,000. New orders kept mounting to $65,009,000 in December from $62,272,000 for November

Wartime Washington

Tool Trading Post

For some time now there has been an informal trading exchange in available tools held daily at the offices of the Reconstruction Finance Corporation. Every day, officials of various procurement agencies, WPB, and RFC get together to go over lists of available tools coming in from RFC district offices. These lists are compared with wants of procurement agencies on requirements lists their representatives bring along with them. When desired machines are located, the interested agency notes where they are located and how they may be secured.

In the event that several agencies require the same machines, the RFC decides who is to get them based upon the urgency of the need.

Tool Sales "Frozen"

Until a short time ago, DPC was permitting negotiation for the sale of surplus tools without concurrence by the Army and Navy. However, the increased ammunition program, bringing with it new demands for tools, resulted in the Army and Navy telling DPC that they were suspending automatic concurrence on sales of surplus tools for the first four months of 1945. Thus, there has been a so-called "soft-freeze" on surplus tool sales since the first of the year.

Unofficially, Army and Navy representatives in the field have not only quit selling tools, but even have stopped talking about surplus tools.

Meanwhile, all surpluses are being carefully screened by the Surplus Property Board before they are offered for sale.

For some time now, war plants requiring machine tools owned by the government for war work have been leasing them through some very involved leasing procedures.

Depreciation Theories

Some observers have noted with interest the widespread feeling among high government officials of the desirability of shortening depreciation to aid post-war employment. At various times, Roosevelt, Byrnes, Hopkins, and Wallace have stated their support for this theory. Wallace wants to permit a five-year depreciation policy, enabling industry to write off as much as 20 percent of its equipment in any single year.

Contrary to administration feeling, industry is divided in its reaction to these propositions. Obviously, such new depreciation policies would hurt established companies, both big and small, but favor new companies. Whereas new companies would be able to reduce their taxes by increasing depreciation allowance, established companies who have used realistic depreciation rates, have been paying heavy taxes on earnings after such depreciation.

From an accounting standpoint, speedy depreciation is inaccurate, complicates bookkeeping practices, and would cause much confusion. Industry spokesmen feel that this "depreciation theory" would not represent actual depreciation, but arbitrary write-offs having no relationships to the actual useful life of the equipment or facility. However, opposition to such government thinking appreciates that the heavy surpluses owned by the government are a factor in these ideas. Depreciation incentives would serve to aid surplus sales.

British Tools Here

Sale of American lend-lease tools to the British reminded some observers of the fact that the British own some $40,000,000 in tools in the United States. These British-owned tools were purchased here by Anglo-French representatives in 1940, and installed in American plants to produce munitions for the British and the French. After the fall of France, the tools were transferred to British ownership to prevent the Nazis from trying to claim them.

At present these tools are being leased to the United States at the nominal rental of $1-a-year, and are being used on American war work. But what will be done with them after the war has not yet been decided. There is little possibility that our government will buy them in view of the 500,000 or so government-owned surplus tools that will be on hand when peace comes. Moreover, chances of marketing them to private industry are none too good, since they are older than most surplus American-owned tools that will be offered for sale.

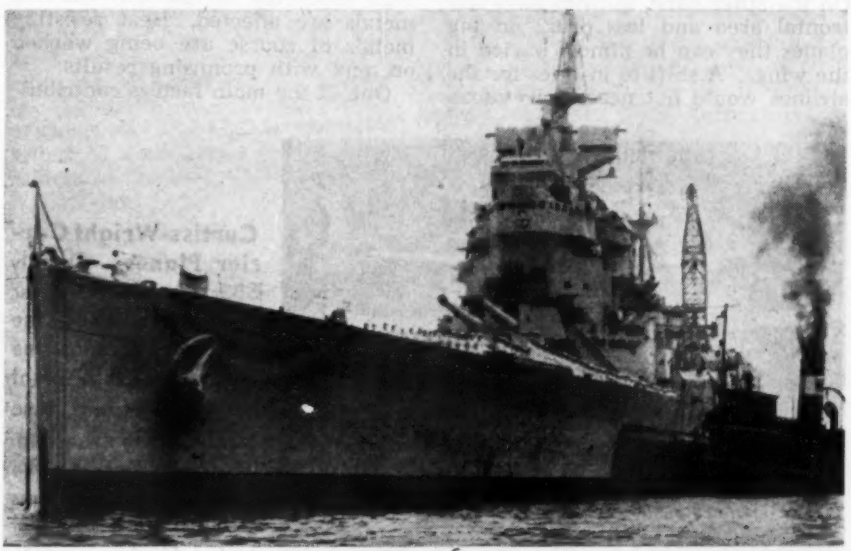
This may leave the British with only two alternatives: either to bring them back to England or sell them in the foreign market.

General Campbell Back

Major General Levin H. Campbell, Chief of Army Ordnance, returned to Washington with high praise for American commanders in the European theatre of war. At a Press Club luncheon, the General outlined his visit to the battle areas in Europe.

Campbell pointed out that various commanders asked for increased output of artillery and ammunition, and that some of it had already been sent abroad, while the balance asked for would be supplied as soon as possible. In discussing spare parts shortages at the front, the General emphasized that it is just a problem of distribution, and that there will always be spare parts shortages somewhere, even in peacetime.

Shortly after his return, General Campbell presented certificates of achievement to WPB's Tools Division, the Chemicals Bureau, and the Metals and Minerals Division, for expediting war production.



—Press Association

British Naval Aid Against Japan—The HMS Howe, flagship of the British Pacific Fleet assembling at Australian bases to operate against the Japs, is shown entering the harbor of Sydney. This 35,000-ton warship with a crew of 1860 officers and men will probably be in the forefront of British action against the enemy in the Far East

Spotting the Air News

In-line Engine Advantages

Military and civilian aircraft operators are seriously considering the use of in-line engines for transport planes. Experience has convinced some designers that they may be able to lower vibration and noise levels by switching from conventional radials to Allisons and Rolls Royces for test purposes. Reports indicate that the Douglas C-54, standard four-engined transport of the Army and Navy, has been making more noise and vibration than operators feel is agreeable for commercial passengers. The C-54 has been ordered by several airlines.

Engine Makers Affected

Though Pan American Airways has had years of experience with four-engined planes, mostly flying boats, for passengers, the domestic airlines have used them very little. The three-engined planes with which most airlines were equipped in the late 1920s gave far too much vibration, but that was because the third engine was on the nose, in direct contact with the fuselage. If it is found that liquid-cooled in-line engines will produce less noise and vibration, the engine industry would be appreciably affected.

The weight-power ratio of in-line engines is now comparable with that of radials, but the liquid cooling systems of in-lines is generally supposed to make them less reliable. On the other hand, in-lines have less frontal area and less drag; on big planes they can be almost buried in the wings. A shift to in-lines for the airlines would not necessarily mean any such change for big bombers and transports.

Jet Noise Problem

One reason for this interest in reducing noise is that some designers expect soon to be making more noise —inadvertently. They have found that, in a plane of big transport size, as much as 20 m.p.h. can be added by the use of the exhaust for jet thrust. To get the jet effect of engine exhaust, short stacks must be used, pointing back directly from exhaust ports. This arrangement appreciably raises the noise level. The use of in-line engines is one of the means being considered to reduce noise, and thereby hold it down around where it is now, with the short stacks. Transcontinental and Western Air is one of the lines interested in this project.

Gas Turbine Progress

Another new power project, which cannot be discussed in any detail, is gas turbines for big planes. It is quite likely that development along this line is being pushed. The gas turbine would practically eliminate engine vibration, but the noise and vibration of propellers would still be there, and the noise of the exhaust, which would be used for thrust. The chief problem in gas turbine design is heat. Efficiency rises almost in a straight-line curve with heat, but long before really high efficiency is reached, existing metals are affected. Heat resisting metals of course are being worked on, and with promising results.

One of the main factors contributing to the impressive increase in power per pound of internal combustion reciprocating engines in recent years is the high compression ratio which has been attained. One of the main factors in the low efficiency of jet and gas turbine power is the low compression ratio it has so far attained. It has already occurred to designers that a reciprocating engine, whose principal power output would be in its exhaust, with a minimum on its crank shaft, might be a way of obtaining higher efficiency in jet propulsion.

Curtiss-Wright Carrier Planes — Deadly SB2c Curtiss Helldiver dive bombers on the conveyor lines at the Columbus, Ohio, plant of Curtiss-Wright, have taken part in every major Naval action. The cannon-firing plane has a four-bladed propeller and a Cyclone engine

Bright Machinery Colors Lift Output and Morale

CLEVELAND—The use of bright, and even dainty, colors on production machinery is being proved effective in giving a simultaneous lift to morale and output, and at no additional cost in maintenance. This is attributed to the fact that workers' spirits and production follow the same curve, varying directly with the cheerfulness of their environment.

A typical test of its value and practicality is reported from the Thompson Aircraft Products Co., Cleveland, where experimental trial in the tool room gave such favorable results that the color scheme is being extended to the entire 2,000 machines in the plant. J. D. Wright, general manager of the $13,000,000 DPC plant employing 9,000 persons, said the criterion of success was worker attitude, rather than any measured increase in production. Checks have been made of individual performance, before and after the transformation from the traditional factory drabness and gloom, with findings that the output was lifted by as much as 15%. However, Wright is among those who consider the intangible factors involved in such checks such as to make them not altogether reliable. He cites among possible errors the fact that output is likely to increase temporarily whenever workers realize they are being checked.

Tapco's Experience Good

Nevertheless, Tapco's experience with bright and cheerful colors, in line with a general policy of removing the plant as far as possible from the conception of a factory as a greasy, unpleasant place to work, has been completely satisfactory.

Its choice of green, for the base of machine tools, buff for silhouetting upper portions, and coral red for moving parts, was a matter of choice among combinations.

Manufacturers of finishes differ somewhat in their approach to this question of color range. E. I. du Pont de Nemours & Co., in "Three-Dimensional Seeing," its study of this new science of color, concludes

that light gray is the most desirable color for the base of machinery, with the contrasting hue of upper or silhouetted portions either buff or light green.

Color Lists Vary

The Sherwin-Williams Co. has published a list of 17 color harmonies, in which the body portion of machines may be either turquoise, green, gray, brown, beige or blue, in combination with these and other colors for upper portions, operating handles and danger points.

The Arco Company, Cleveland, released this week a newly prepared guide to color selection in applying its "Optonic" system, which employs five shades of accurately measured reflection value in each of five colors —blue, green, tan, coral and gray.

Tapco uses coral for high visibility on danger points. Lift trucks are the same color, and the same harmony is preserved in walls, traffic zone marks and dado stripes.

The Pittsburgh Plate Glass Co. in its booklet "Color Dynamics," recommends generally a dark "Vista green" for the "non-critical" parts of the machine, and suggests a range of 11 "focal colors" for "critical" parts, selection to be made with consideration to obtaining contrast between the machine and the material being processed.

These principles cover the range of those advanced by the many manufacturers who have entered this field.

Lighting Factor Important

Universally recommended, in connection with the use of color to promote continuity of employment and improve operation efficiency, is a coincident study of lighting. First to explore the possibilities for reducing fatigue and adding speed by increased illumination. Secondly the paint makers cite the fiindings of illuminating engineers that visual accuracy is reduced when brightness of surroundings is either greater or less than that of the task. Thus the colors chosen for machines should have a brightness factor about equal to that of the material being processed.

The reflection value of the light colors being offered for machines varies from about 25 to 40 per cent, two to three times the reflectance of a standard machine tool gray.

Fabricated Item Contrasts

Background may be either somewhat lighter or a different color, to obtain contrast with the product. For example, bronze under fabrication will show to advantage against a green. A textile mill uses turquoise to obtain a contrast with white thread. While dainty shades are obviously inappropriate for a steel mill or forge shop, lighter colors than the conventional black or dark gray are being used with gratifying results. Tapco's management joins many others in reporting that workers themselves assist in keeping machines clean, helping thereby to keep maintenance costs at previous levels.

As a preliminary to the application of color to machines or the plant itself, authorities are unanimous in recommending "streamlining." Equipment is arranged in orderly manner, stockpiles and any clutter removed to separate buildings, on the principle that quiet harmony and dignity cannot be fully attained in the midst of disorder.

Names in the News

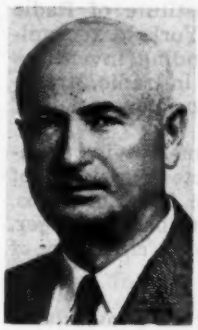
Ralph J. Cordiner has been elected vice president and assistant to the president of the General Electric Co., Schenectady, N. Y. Mr. Cordiner had been connected with G. E. for almost 20 years when he resigned in 1939 to become president of Schick, Inc., Stamford, Conn. In December 1942, Mr. Cordiner entered the government service as director general of war production scheduling and vice chairman of the WPB. Since his resignation from the WPB 18 months ago, Mr. Cordiner has been assistant to the president of G. E.

William H. Colvin, Jr. has been elected president of Crucible Steel Co. of America to succeed **Joseph H. Callan,** who resigned to become chairman of the company's executive committee. For the past nine years, Mr. Colvin has been president of Rotary Electric Steel Co. of which he was one of the founders in 1933.

Frederick Kalmbach, Jr. has been elected president of the General Machine Co., Inc., Emmaus, Pa., to succeed his father, **Fred Kalmbach,** who remains as chairman of the board. At the same time **M. Lindroth,** production manager and purchasing agent, was elected vice president of the company.

Arthur R. C. Markl has been appointed chief research engineer of Tube Turns, Louisville, Ky. Before joining Tube Turns, Mr. Markl was associated with the M. W. Kellogg Co., New York, N. Y., for 14 years.

T. W. Pettus, executive vice president of the National Bearing Metals Corp. before it was merged with the American Brake Shoe Co. as a full-fledged divison, has been named president of the new National Bearing Division.



Charles Eisler

R. L. Heath

Charles Eisler, owner and director of the Eisler Engineering Co., Newark, N. J., was elected president of the Resistance Welder Manufacturer's Association at their January meeting. Co-vice-presidents of the association elected at the same time are **David Sciaky** of Sciaky Bros. in Chicago, and **H. V. Beronius** of Welding Machines Manufacturing Co., Detroit.

R. L. Heath recently joined the Climax Molybdenum Co. as metallurgical engineer with headquarters in St. Louis, Mo. Mr. Heath was formerly chief metallurgist of the Allison Div., General Motors Corp., Indianapolis, Ind.

A. G. Haglund, vice president in charge of lathe sales of the Axelson Manufacturing Co., Los Angeles, Calif., has resigned and will be replaced by **W. H. Jackson,** who has been with Axelson since 1908 in various positions.

B. A. Gillies has been appointed to the dual position of assistant to the president and director of flight and service of the Ryan Aeronautical Co., San Diego, Calif. For the past ten years Mr. Gillies has been vice president of the Grumman Aircraft Engineering Corp., Bethpage, L. I., where he has been active in planning and organizing the production system for "Hellcats" and other Navy fighter planes.

E. J. Kelley has recently been named vice president in charge of engineering of Skilsaw, Inc., Chicago, Ill. Mr. Kelley was formerly secretary and for many years directed engineering and new product development.

Corbet L. Drewry has been appointed assistant co-ordinator of controls of the Department of Munitions and Supply, Ottawa, Canada. Mr. Drewry joined the Department in November 1942 as director general of the Toronto office.

Ernst F. W. Alexanderson was awarded the Edison Medal of 1944 at a recent joint session of the American Institute of Electrical Engineers and the Institute of Radio Engineers in New York in recognition of his "outstanding inventions and developments in radio, transportation, marine and power fields."

O. G. Mandt, formerly vice president, has been elected president of the Jaeger Machine Co., Columbus, Ohio, to succeed **Gebhard Jaeger,** who has been named chairman of the board.

Donald Price, formerly associated with the Interchemical Corp. and National Oil Products Co., has been appointed technical director of Oakite Products, Inc., New York, N. Y. Dr. Price will direct the activities of the company's chemical and engineering staff and research laboratory.

Carlton J. Daiss has become associated with **Charles E. Moore,** president of Joshua Hendy Iron Works, Sunnyvale, Calif., in the administration of his various enterprises.

B. N. Ashton, formerly executive vice president in charge of engineering, has been appointed president of Electrol, Inc., Kingston, N. Y.

OBITUARIES

Oscar Swanson

Oscar A. Swanson, president of The Swanson Tool & Machine Products, Erie, Pa., died January 26th at the age of 66. Mr. Swanson was widely known in the tool industry, especially in connection with the building of special tools. He was frequently called in on vital tooling jobs for the war effort. His position will be assumed by his son, Leonard, long associated in the business.

William R. Martin, 64, president of the W. R. Martin Machine Co., Louisville, Ky., since 1905, passed away February 8.

Oscar Tuerck, partner in the concrete machinery and products firm of Tuerck-MacKenzie in Portland, Ore., for nearly 50 years, died February 4 following a long illness.

BUSINESS ITEMS

John C. Cotner

The Geroter May Corp. of Baltimore, Md., has acquired the **Cotner Machine Products Co.,** Logansport, Ind. **John C. Cotner,** a founder of the Logansport firm, has become vice president of Gerotor May, member of its board and general manager of its Logansport division. Personnel and products will remain the same, but additional facilities will be available shortly under the firm's plan for expansion.

Articles of incorporation have been filed for the **Precision Welder and Machine Co.,** English and Neave Sts., Cincinnati, Ohio. The new company will build a complete line of spot, projection, seam and flash butt equipment. **T. Embury Jones,** until recently vice president and manager of the welder division of Federal Machine and Welder Co., Warren, Ohio is president and treasurer of the new firm, while **E. W. Forkner,** formerly chief engineer and production manager of Federal, is vice president in charge of operations.

The Materials Handling Institute, including 34 firms, has been formed with headquarters at 208 So. LaSalle St., Chicago 4, Ill. **Lawrence J. Kline** of The Mercury Manufacturing Co., Chicago, Ill., has been elected first president of the institute, which is designed to serve as a medium for the exchange of facts and information relating to industrial material handling and the activities of manufacturers in that field.

Barber-Colman Co. has opened a divisional machine tool engineering and sales office at 832 W. Fifth St., Los Angeles 13, Calif., under the supervision of **Roy H. Jones,** who has been associated with Barber-Colman for over 27 years. At the same time, Barber-Colman appointed **the Garrett Supply Co.,** 3844 So. Santa Fe Ave., Los Angeles 11, Calif., as its representative in southern Calif. and Ariz.

The **General Machine & Welding Co.,** 923 Market St., Wheeling, W. Va., has changed its name to **The Specialty Machine Tool & Die Co.**

Aeon Industries, formerly of 954 So. La Brea Ave., Los Angeles 36, Calif., has moved to larger quarters at 4310 Degnan Blvd., Los Angeles 43, Calif.

Mead Specialties Co. has moved to a new factory at 4114 N. Knox Ave., Chicago 41, Ill.

Leonard A. Yoder

Joseph C. Jones

The firm of **Jones & Yoder** has been organized with offices at 5500 Walworth Ave., Cleveland, Ohio; 110 E. 42 St., New York, N. Y.; and 3701 No. Broad St., Philadelphia, Pa., as engineering and sales representatives of machinery manufacturers. The heads of the new enterprise are **John C. Jones** and **Leonard A. Yoder.** The firm will cover the eastern seaboard from New England through Md., including eastern Pa.

The **University of Louisville** has established a non-profit organization—the **Institute of Industrial Research**—which will engage in engineering and scientific research for industrial and private clients on a contract basis.

Rochester Bevel Gear Co., 625 So. Goodman St., Rochester, N. Y., has been organized to manufacture spiral and straight bevel gears. Complete service is offered, including blanking, cutting, developing, and a running test by the partners —**Oscar E. Klumpp** and **William B. Griffin.**

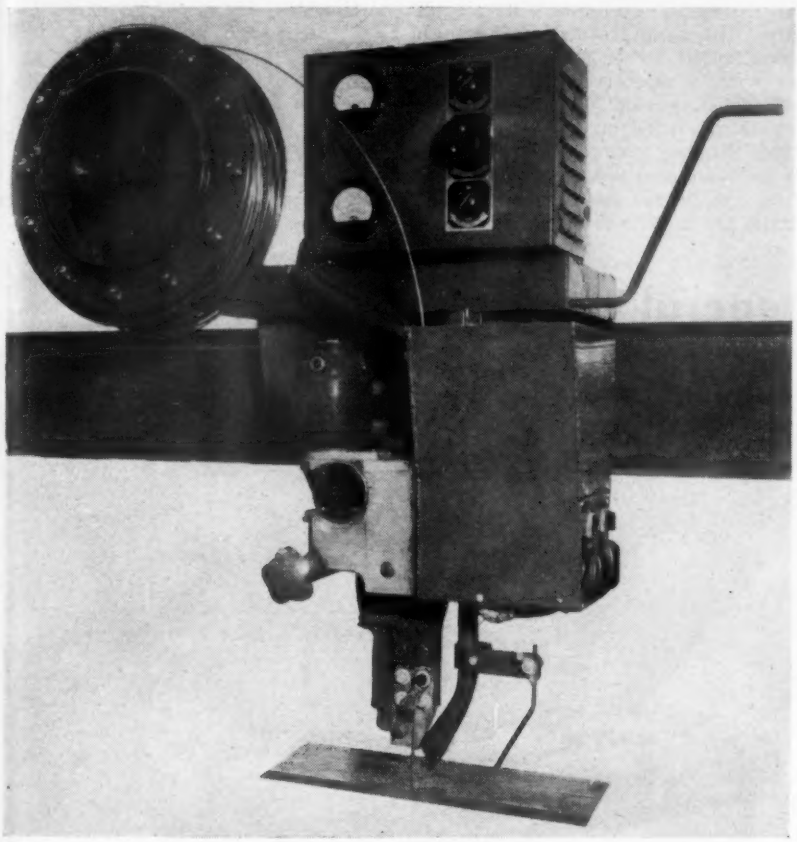
The firm of **Joseph Monahan,** 351 Indiana Ave. N. W., Grand Rapids 4, Mich., has been named exclusive sales representative for the **G. A. Gray Co.,** Cincinnati, Ohio, in the western Mich. territory.

Sciaky Brothers, Chicago, Ill., has opened a new office at 1775 Broadway, New York, N. Y., with **Robert Santini** as district manager.

MEETINGS

Society of Automotive Engineers. Aircraft Materials and Processes Committees meeting. Roosevelt Hotel, New Orleans, La. Feb. 27-March 2. J. D. Redding, Secretary, 29 W. 39 St., New York, N. Y.

Shop Equipment News



Lincolnweld automatic welding head

Lincolnweld Automatic Welding Machine for Production Operation

The Lincolnweld automatic welding machine, manufactured by the Lincoln Electric Co., 12818 Coit Road, Cleveland, automatically feeds bare welding electrode wire, from reels to the joint to be welded, through a granular shielding flux deposited on the joint. The wire is gripped between the surfaces of rolls driven by a feed motor and controlled by an exciter which automatically adjusts the feed rate to the welding requirements.

The granular flux is applied to the arc and molten metal by means of a delivery tube from an attached flux hopper. Flux remaining unfused after the welding operation is recovered and reused.

The welding control consists of a welding current rheostat of 300-1,200 amp. range, an arc voltage rheostat and an electrode feed motor rheostat, one exciter for electrode feed motor control and another for the welder field excitation, all contained in a small welding head control box.

The welding current delivered to the control is d.c. derived from an automatic welding generator set of 1,200 amp. capacity. The use of d.c. welding current offers improved control of electrode melting rate, through the option of either straight or reversed polarity welding, and the ability to weld non-ferrous metals. Direct current also permits the use of extremely high current densities to produce greater penetration and allow smaller cross-section of weld materials with a resultant reduction in warpage and distortion.

The welds produced by the Lincolnweld machine meet the requirements of welding codes and specification of the following: A.S.M.E. Power Boiler code; A.P.I.-A.S.M.E. Unfired Pressure Vessel code; Rules of American Bureau of Shipping; Lloyd's Register of Regulations and the United States Maritime Commission.

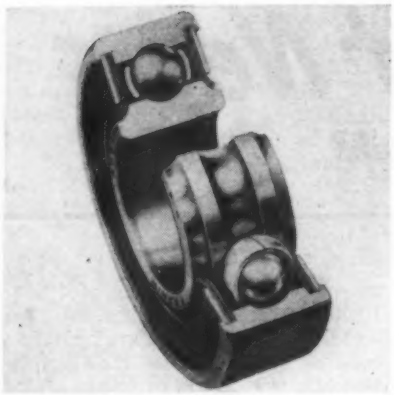
It has been submitted to field tests and used to weld a variety of products, machine bases, motor and generator frames, fans, tanks, landing craft and many parts used in the prefabrication of ship and railway equipment.

Lincolnweld head mounted on power-driven carriage

Strengths of Welds Produced by Lincolnweld Process

MATERIAL (As Welded)	YIELD Psi.	TENSILE Psi.	DUCTILITY %Elongation in 2 inches
Low Carbon Steel (Armco Ingot Iron)	36,000	53,000	34
Medium Carbon Steel (Ship Plate)	49,000	68,000	31
High Carbon 0.40% (Gear Steel)	64,000	87,000	24
*Pressure Vessel (Steel Plate)	55,000	74,000	27

Stress relieved at 1200 deg. F.



Plya-Seal bearing

Fafnir Plya-Seal Bearings Sealed in Standard Widths

A sealed ball bearing, held to the same widths as standard unsealed bearings with the exception of extra small sizes, is manufactured by the Fafnir Bearing Company of New Britain, Conn., as the Plya-Seal bearing. The sealing element consists of a diaphragm-type contact seal comprising a flexible sealing washer of synthetic rubber-impregnated fabric and a split retaining ring of spring steel. The sealing washer does not rotate with the inner ring but is in contact with a ground groove to form an effective seal. The seal material is non-capillary and impervious to grease, oil, gasoline, water and various solvents. The seal is easily removed for lubricant renewals and inspection.

Truline Mold Spray Reduces Green Spots and Burn-outs

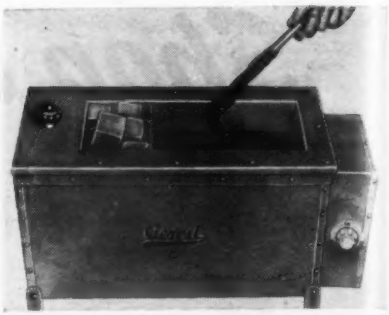
The Hercules Powder Company of Wilmington, Delaware, has developed a solvent-type mold spray made from a special resin dissolved in a quick-burning solvent. The spray, known as Truline Mold Spray 91, is applicable to the production of steel, iron and nonferrous castings.

Tests in the Hercules foundry laboratory and in production foundry operations on both natural and synthetic bonded molding sands indicate it strengthens, hardens and dries the mold surface in one operation. It is applied by a spray gun, dip tank or brush, and is then ignited and burned off the mold, leaving a thin film of resin on the surfaces. The mold is ready for use immediately after burning. The surface strength of the resinous coating is sufficient to bridge across most green spots in the mold and eliminates or greatly reduces the number of burn-outs. The general surface of castings produced using Truline Mold Spray is also improved.

Plast-O-Dip Tank for Plastic Coating Tools, Dies and Parts

A hot dip tank for applying protective plastic coatings to precision parts, small tools and dies is manufactured by the Aeroil Burner Co. of West New York, New Jersey. The Plastic-O-Dip model 3 is built on the principle of the double boiler and is heated by means of a 1,200-watt immersion element in an oil bath. The temperature of the bath is controlled by a built-in thermostat with a selective dial for temperature ranges of 100 to 550 F. The tank is insulated on all sides.

The dipping space is 16 in. long, 6½ in. wide and 6 in. deep. A partition can be set across the tank to permit the addition of plastic compound blocks without interfering with its use.



Plast-O-Dip tank

The unit operates from 110 volt d.c. or a.c. or 220 volt a.c. power supply.

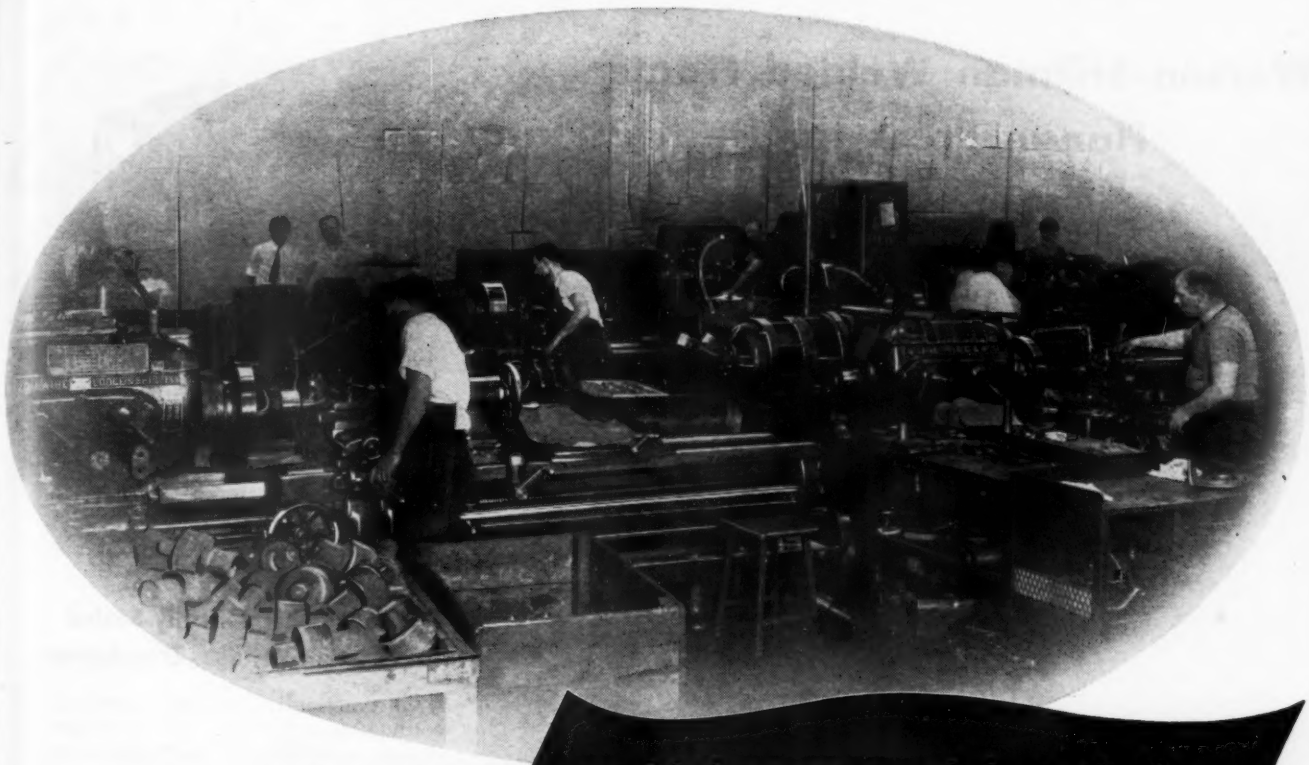
General Electric Induction Heater Provides 50 kw. for Larger Parts

G.E. induction heater unit

A 50 kw. electronic heater for surface and localized hardening of gears, rods and other parts and for annealing, brazing and soldering operations, is manufactured by the Industrial Heating Division of General Electric. The heater incorporates all of the important features of the 5 kw. and 15 kw. G.E. heaters and is capable of heating larger parts or the same size parts in less time. It is applicable to different heating jobs by changing the induction fixture.

The parts to be heated are positioned in the fixture and the start button pressed. Automatic controls then regulate the heating and quenching cycles controlling the duplication of results on succeeding parts. An attached worktable provides two heating positions, permitting full utilization of the high-frequency power supply.

Inclosed in grounded steel to minimize radiation and protect the operator, the entire unit weighs 6,000 lb. and is 84 in. wide, 94 in. deep and 82 in. high. Meters and controls are mounted on the front of the unit to permit easy operation.



LODGE & SHIPLEY LATHES at work

machining spur pinion shafts FOR A BULLARD WAR CONTRACT

● As a machine tool builder, Bullard fully appreciates the many advantages a manufacturer obtains by using the latest machine tool developments.

To help assure greater speed, precision and quality in the production of their own machine tools, and their sub-contracting work, Bullard utilizes a big battery of Lodge and Shipley's newest 18″ and 20″ Engine Lathes.

These L & S Lathes are a great step forward in design and performance—meet the most exacting requirements of forward-looking manufacturers like Bullard.

Completely new from headstock to tailstock, these powerful lathes set new standards for output, accuracy and smooth operation. A wide range of spindle speeds, feeds, and threads assure maximum adaptability . . . permit full use of the cutting possibilities of all types of tools. Many other new features contribute to their superior lathe performance.

L & S Engineers will show how your work can profit by these new lathe developments. For details and specifications on L & S 18″, 20″ and 22″ Engine, Tool Room and Manufacturing Lathes, write on your company letterhead for Bulletins No. 474, 482, 605.

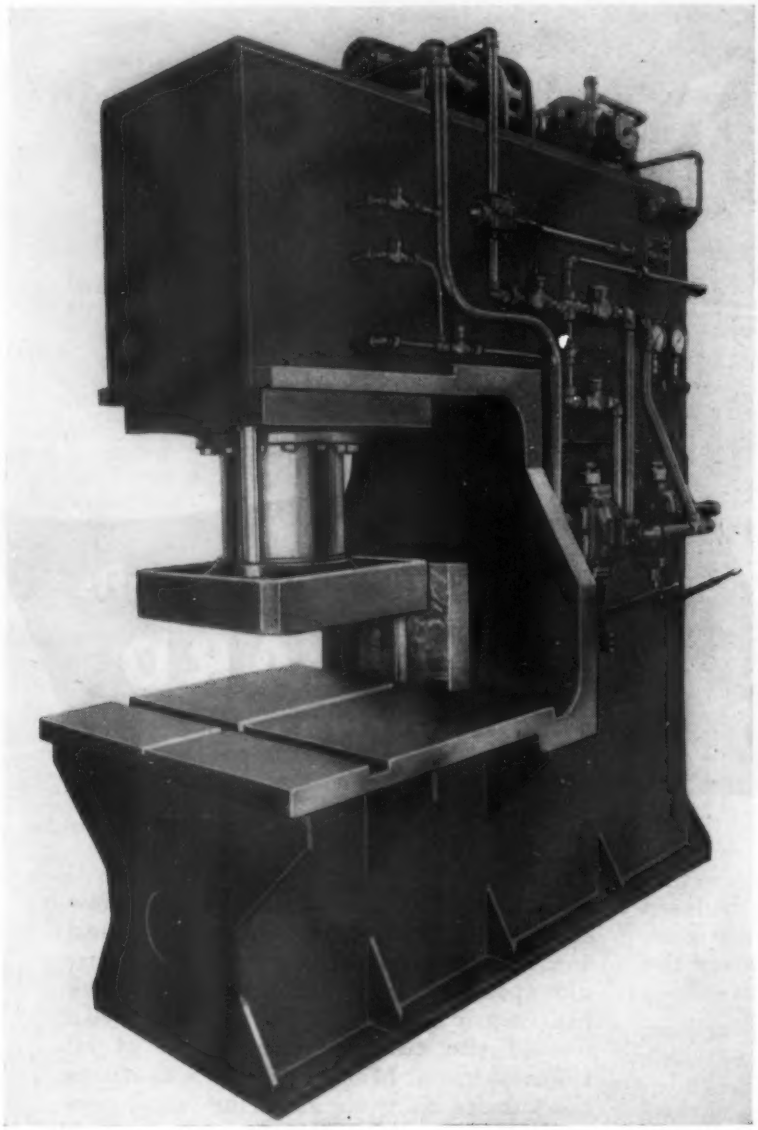
THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI 25, OHIO, U. S. A.

L & S LATHES

ENGINE — TOOL ROOM — AUTOMATIC — OIL COUNTRY LATHES

Watson-Stillman Welded Frame Flange Press for Heavy Plate



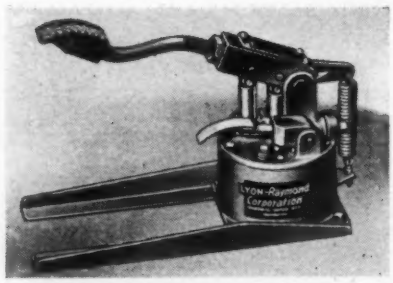
Watson-Stillman flange press

A 500-ton gap-type flanging press by the Watson-Stillman Company of Reselle, New Jersey, has a frame of welded steel construction to enable it to handle heavy plate work.

The press has a dual delivery pump with a capacity of 103 g.p.m. at low pressure and 14.7 g.p.m. at high pressure. It has an operating pressure up to 2,900 lb. per sq.in. The press bed is 66 in. by 55 in.; vertical ram with a capacity of 500 tons has a stroke of 12 in., 28-in. throat and a platen of 36 by 36 in. The horizontal ram, with a 250-ton capacity and 7-in. stroke, has a 24 by 24 in. platen. Separate controls are provided for each ram. The pump and motor have been located on top of the press to minimize accidental damage by trucks and heavy loads.

Lyon-Raymond Hydraulic Foot Pump Develops 10,000 PSI.

A two-speed foot pump with a high-speed low-pressure piston and a low-speed high-pressure piston has been developed by Lyon-Raymond of 1997 Madison St., Greene, N. Y. The change in pumping speed is automatic. Up to 1,000 lb. pressure, both pistons pump oil, at that pressure the high-speed low-pressure piston cuts out and pressures up to 10,000 lb. are developed by the small high-



Lyon-Raymond hydraulic foot pump

pressure piston. Maximum pressure can be pre-determined by the adjustment of a relief valve. It is supplied with floor stand brackets or direct mounting brackets.

Sola Makes Hermetically Sealed Constant-Voltage Transformer

A hermetically sealed constant-voltage transformer for through-chassis mounting, is available from Sola Electric Co., 2525 Clybourn Ave., Chicago 14, Ill. It is designed for use with electronic gaging and inspection equipment and other applications where precisely regulated supply voltage is necessary. At any reasonable transformation ratio of input to output it provides a single-output voltage constant to within ± 1 percent of rated requirements regardless of line-voltage variations as great as ± 12 to 15 percent. Capacities to 15 va., 60-cycle operation are available and are supplied with a separate capacitor unit for external mounting.

Adjustable Spanner Wrench by Universal Handles Many Sizes

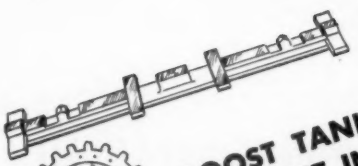
All diameters of spanner nuts from ⅜ in. to 5 in. can be operated by a set of three self-adjusting spanner wrenches manufactured by the Universal Engineering Company of 2230 National Avenue, San Diego 2, Calif.

Uniform pressure against the nut

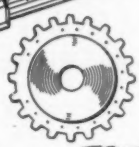
Universal spanner wrench

is claimed to be accomplished by the 3-point toggle action of the movable jaws. All parts are made of alloy steels designed to resist high leverage stresses.

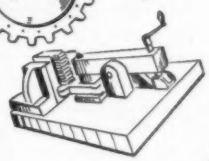
The Kind of Job Colonial Broaches helped to do.....



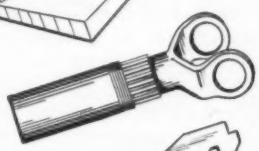
1 CUT COSTS OF AUTOMATIC RIFLES 57%



2 BOOST TANK SPROCKET PRODUCTION 300% WITHOUT INCREASE IN MAN POWER OR MACHINES

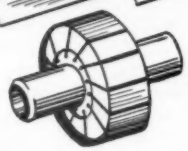


3 MACHINE 7 DIFFERENT PARTS IN 60 SIZES ON ONE MACHINE



4 PRODUCE SPLINE FITS WITH "ZERO" BACKLASH

5 MAKE ONE BROACHING MACHINE DO THE WORK OF 3, 6 OR MORE MILLING MACHINES



6 TURN OUT PARTS IN PRODUCTION TO TOOL ROOM PRECISION

Those are just a few typical examples. Colonial field engineers can help you cut costs, boost output, or increase precision. A call, a letter or a wire to Colonial will pay dividends.

Are you on the mailing list to receive "Broaching News"?

colonial BROACH COMPANY
DETROIT 13, U.S.A.

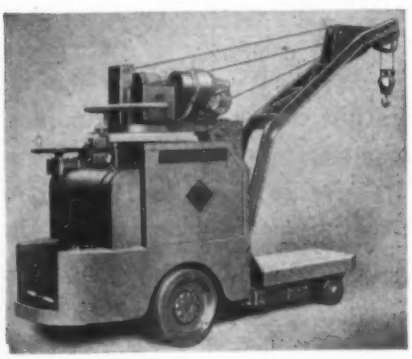
Broaches *Broaching Machines - Broaching Equipment*

Upton Furnace Starting Coil Melts Solidified Salt Baths

A salt bath starting coil consisting of a nichrome heating element that connects to the transformer of an electric salt bath furnace by means of two mild steel bars and flexible buses is a product of the Upton Electric Furnace Div. of 7450 Melville, Detroit 17.

The coil can be used either before or after the salt in the furnace is allowed to freeze up. When the furnace is to be shut down, the coil is dropped to the bottom of the pot. When starting up, the buses are connected to the transformer and the power turned on. With heat from both starting coil and furnace electrodes, the salt melts quickly. The same procedure can be used to start a furnace that has been allowed to freeze without immersion of the starting coil.

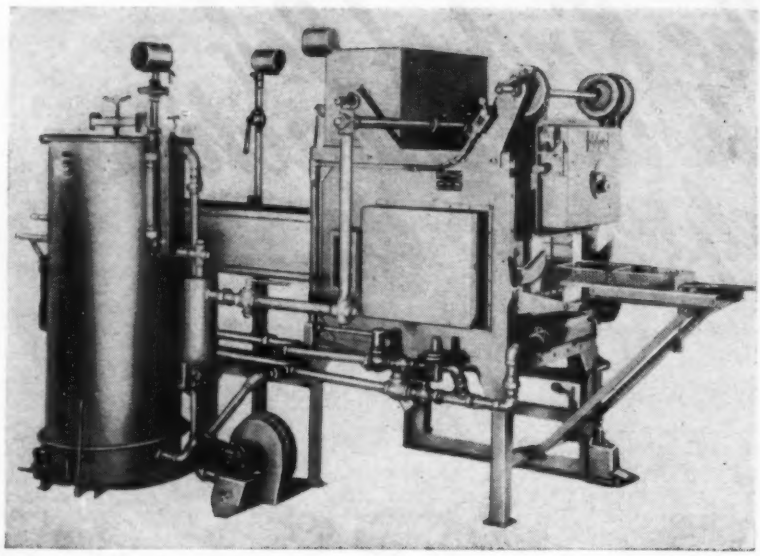
Upton salt bath starting coil



Elwell Parker crane truck.

Elwell Parker Combination Crane Truck Hook Improved

The model L-11C combination crane truck by the Elwell Parker Electric Co. of Cleveland, has improved operating characteristics with the addition of a separate motor for raising and lowering the boom. In previous models a single motor served to raise and lower both boom and hook by means of a ratchet adjustment which was actuated when the lift hook was pulled up against the boom. By providing a separate motor for each function the operator is given greater freedom in load handling operations. It will travel at 6 miles per hour with no load and 5 miles per hour with full load.



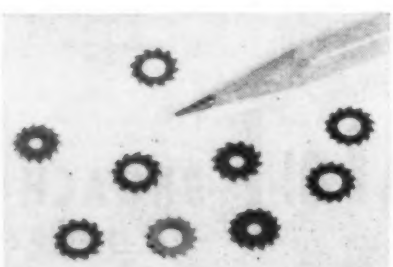
Lindberg all-purpose furnace

Tungsten Carbide Commutator Saws Developed by Super Tool

The Super Tool Company of 21652 Hoover Road, Detroit, has developed a line of commutator saws of solid tungsten carbide in sizes from ¼ in. to 1 in. diameter.

Laboratory and production tests indicate tungsten carbide is an excellent material for precision cutting of commutator grooves. The hardness of the material is claimed to provide for exceptionally clean cuts that permit the elimination of hand-filing clean-up operations.

They are supplied in thicknesses of .015 in. and up to suit the requirements of most shallow grooving operations.



Super Tool grooving saws

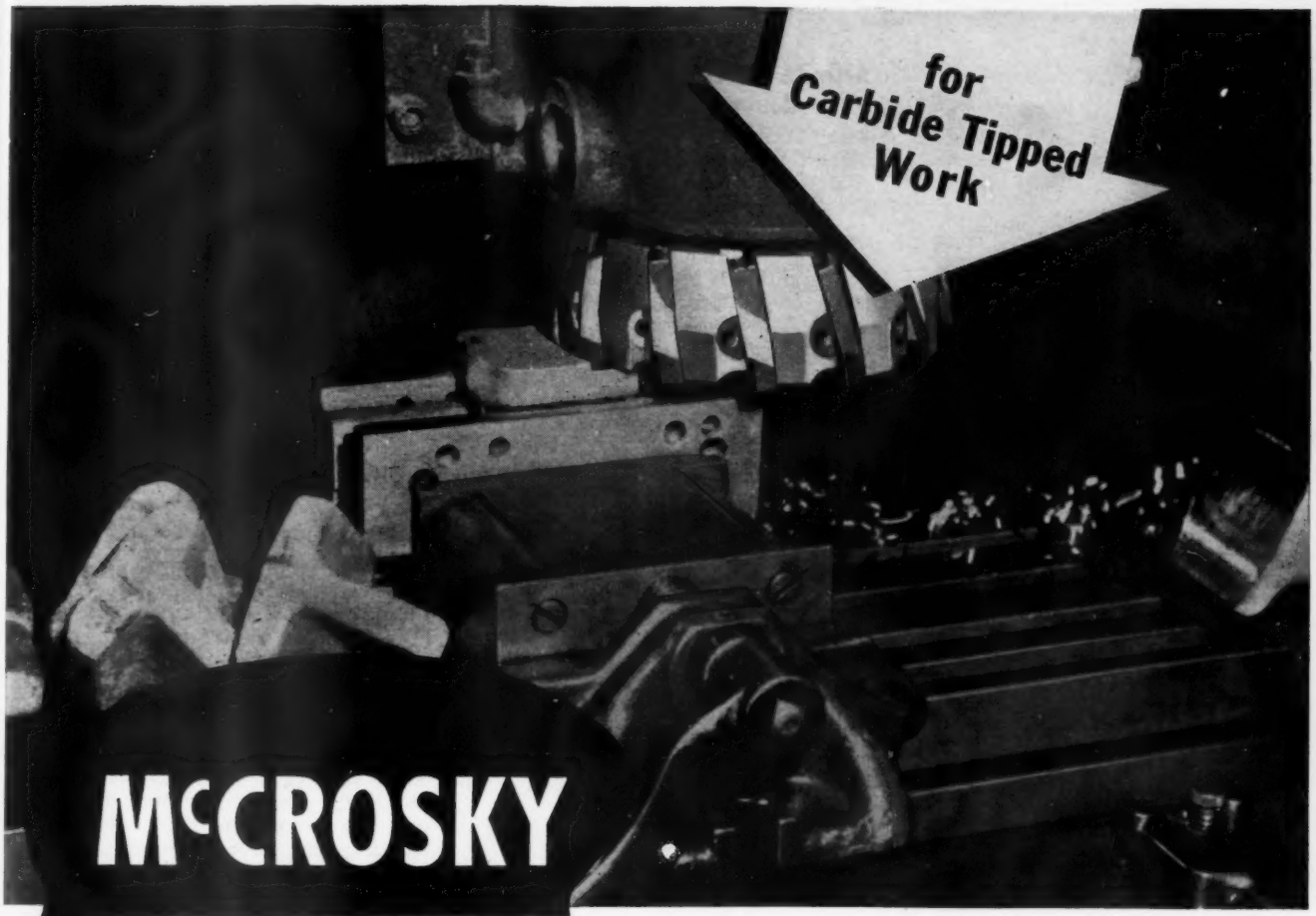
Lindberg All-purpose Furnace For Brazing and Hardening

An all-purpose furnace designed for low-temperature silver brazing, high-temperature copper brazing, powdered metal sintering, bright annealing and tool hardening has been developed by the Lindberg Engineering Co. of 2444 West Hubbard Street, Chicago 12.

Flexibility in use is claimed to be the result of its range of attainable working temperatures—from 1,300 deg. F. to 2,500 deg. F. Handling work in the furnace has been simplified by the specially designed loading and unloading platforms. A flame curtain at the charge and discharge doors of the furnace ignites automatically when the doors are opened. This permits the use of a non-oxidizing atmosphere in the furnace and water-cooled cooling chamber. The furnace is equipped with globar-type heating elements to reduce maintenance time and shutdowns. It has been designed to permit the use of hydrizing equipment manufactured by Lindberg.

Jackson J-1 Face Shield Provides Unhampered Vision

Type J-1 shield for protecting the eyes and face, announced by Jackson Products, 3265 Wight St., Detroit 7, Mich., is featherweight and quickly and comfortably fitted to any head by means of a sliding fiber head-strap. The fully bound, flexible, quickly replaceable, snap-on Plastacele visor provides wide unhampered vision and is adjustable at any angle. Visors are supplied in 4, 6 and 8 in. depths in clear, light medium and dark green shades.



*Jack-Lock MILLING CUTTERS

*PATENTED

Taking a 1/4" to 5/16" cut in 4130 steel heat treated forgings, with spindle speed of 218 R. P. M., 14 5/8" feed, and .0045" feed per tooth, this carbide tipped job demonstrates the advantages of McCrosky's Jack-Lock construction.

Conceived and perfected by McCrosky engineers, the Jack-Lock wedge gives inserted blade tools the strength and rigidity of solid tools,—yet permits easy and quick release of the blades without hammering, or accidental damage to the blades or the tool. Fine pitched screws in back of each blade assure accurate and uniform adjustment for regrinding, resulting in minimum blade loss,—more accurate and speedier regrinding—permitting a job to be kept in continuous production with fewer, sometimes only a single standby tool. Specify "McCrosky" for increased production and lower costs.

McCROSKY TOOL CORPORATION
MEADVILLE, PA.

COST CUTTING TOOLS

Designers and Manufacturers of

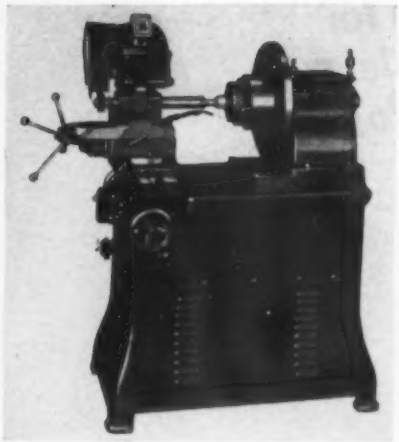
Jack-Lock MILLING CUTTERS

Block Type BORING BARS

Wizard CHUCKS AND COLLETS

Super Adjustable REAMERS

Turret TOOL POSTS

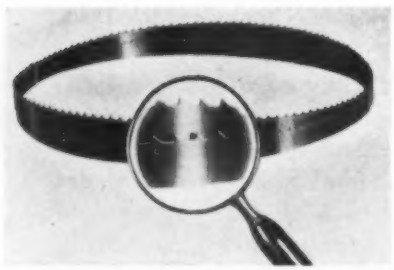


Lempco ACX Grinder

Lempco Internal and Surface Grinder Has Automatic Sizer

The model ACX machine for internal, external, face and taper grinding manufactured by Lempco Products of Bedford, Ohio, mechanically duplicates sizes of successive workpieces.

Precision face grinds are made possible by the micrometer screw adjustment on the automatic power cross-feed. The spindle is driven at 6,000 or 12,000 r.p.m. by a 2 hp. grinding head motor. The ½ hp. workhead motor drives the workpiece at 80 or 130 r.p.m. Jaw or magnetic chucks are mounted on the faceplate by a bar through the hollow spindle. The built-in coolant system has been made accessible for cleaning.



Barnes skip tooth saw

Barnes Skip Tooth Band Saw Cuts Without Clogging Teeth

A skip tooth band saw designed for cutting of magnesium, aluminum, brass and the non-ferrous soft metals as well as plastic, fiber and wood, is manufactured by the W. O. Barnes Company, of 1297 Terminal Ave., Detroit 14. It is of hard edge, flexible back construction to fit any standard band saw machine and can be used until completely worn out without resharpening.

Alemite "Versatal" Pump for Heavy Fluids Now Available

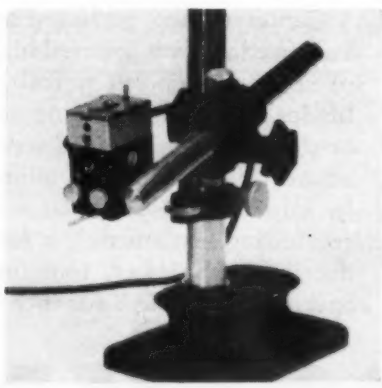
The "Versatal" material pump is designed to dispense paints, lacquers, sealers, fibrous and other plastic coatings from any 54 gal. barrel. A 12 gal. container is supplied with a portable model.

The pump is operated by air pressure and supplies material to as many as six spray heads at pressures of about five times the air line pressure fed to the pump.

Alemite Versatal pump

This pump does not require an air head in the barrel or material container and an even material mixture is maintained by a built-in automatic agitator.

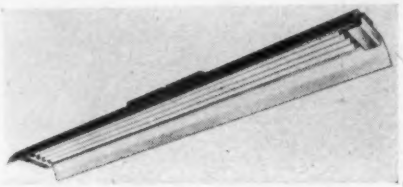
The "Versatal" is manufactured by Alemite of 1826 Diversey Parkway, Chicago.



P & W reversible Electrolimit gage

New Electrolimit Gage Head Measures Either up or down

A newly designed head for its Electrolimit height gage, announced by the Pratt & Whitney Division, Hartford, Conn., can be adjusted to measure either up or down. The head may be purchased separately for replacement of an old model head, or it may be had complete with indicator and either of two stands.



Colovolt fluorescent lamp

Colovolt Fluorescent Lamp Has 10,000 Hour Service Life

The Colovolt lamp is a cold cathode, low voltage, fluorescent type developed in the research laboratories of the General Luminescent Corp. of 638 Federal St., Chicago. The electrodes of the Colovolt have been designed to operate with cold cathodes; this type cathode previously required exceptionally high voltages but the developments of General Luminescent have made it possible to operate cold cathodes with low voltages. The 10,000 hour Colovolt lamp starts instantaneously and is guaranteed for a full year.

Modernair No. 10 Chuck Speeds Drilling Operations

Modernair chuck No. 10, announced by Modern Products, Ltd., 952 South Grand Ave., Los Angeles 15, Calif., is intended for handling parts in operations requiring the chucking surface and operation to be concentric with each other.

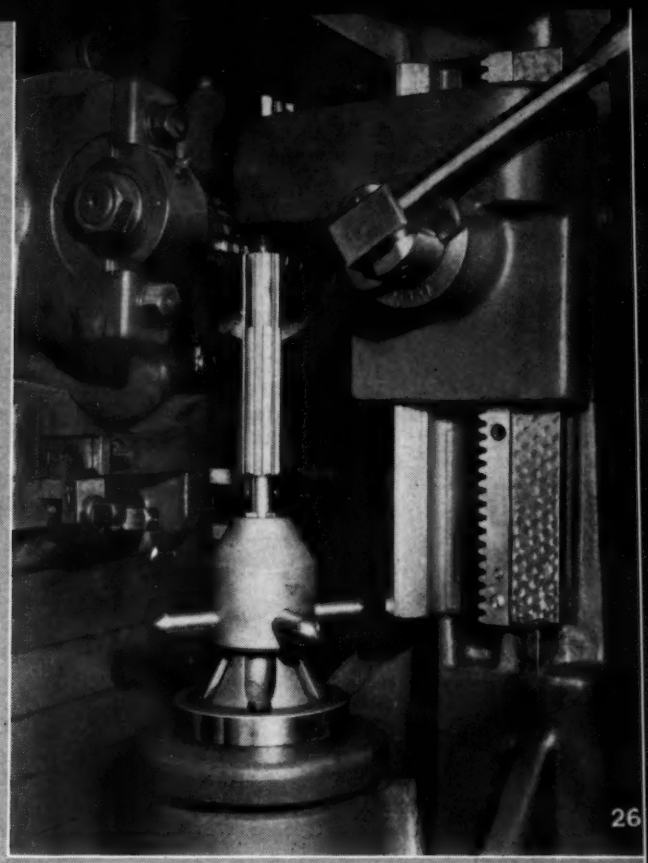
Though the standard model is equipped to handle 5-C collets up to 1 in. dia., inexpensive and easily changed adapters make possible raising the capacity to 1⅜ in. dia. with 2-J collets.

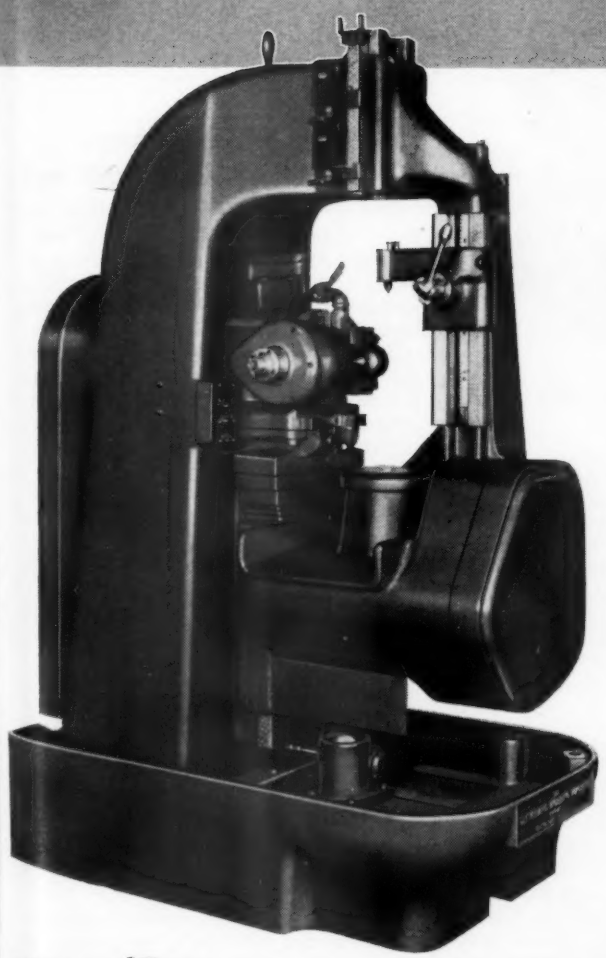
The top casting section has a 1 in. thickness, into which ¾ in. deep holes can be drilled and tapped to secure special jigs to the chuck. Chuck operation is controlled by a foot valve.

Modernair chuck No. 10

Hobbing Splines

RAPIDLY
ACCURATELY
AT LOW COST
on the
RIGIDHOBBER





By this method a finished piece is turned out at every complete cycle. All motions of both work and cutter are rotary thus eliminating any indexing or reciprocal movements. This permits simple, rigid machines and tooling to be used.

For example—you will note the spline shaft above is held rigidly between centers and the hob is also strongly supported at both ends.

This rigidity permits the maintenance of exceptionally close tolerances and makes for faithful duplication of all work.

If you want accuracy and high production at low costs put your gear and spline hobbing jobs on a Rigidhobber.

The **CLEVELAND HOBBING MACHINE** *Company*

General Offices:
1311 CHARDON ROAD
CLEVELAND 17, OHIO

Chicago Office:
624 S. MICHIGAN AVE.
CHICAGO 5, ILLINOIS

BUILDERS OF RIGIDHOBBERS AND

Ideal Wire Stripper Removes Insulation and Collects Dust

All types of insulation, including enamel and fiberglass, are removed from any size or shape of single or multiple strand wire by the Ideal brush-type stripper. Two motors are used to power the opposing stripping brushes. The brushes, normally held apart, are brought in contact with the work by depressing a foot pedal. Pedal operation can be eliminated by presetting to wire

Ideal wire stripper

size. The strippings are collected by an individually powered dust collector.

Provision has been made by the manufacturer, Ideal Commutator Dresser Company of 1057 Park Avenue, Sycamore, Illinois, for installation on any production line bench.

Round Test Gages are Carbide Tipped by Yankee Precision

Round test plug gages are formed in a true arc of the gaging dimension on a carbide contact surface. The high abrasion resistant qualities of the gaging surfaces is claimed

Carbide tipped gage

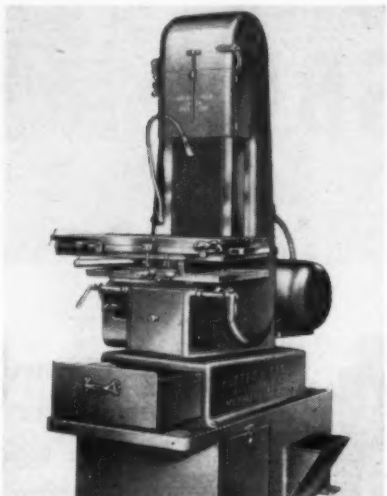
to extend the useful life of the gage beyond that of untipped gages.

The gages are manufactured in standard sizes and to special order by the Yankee Precision Products Company, 965 Farmington Avenue, West Hartford 7, Connecticut.

Porter-Cable Automatic Feed Table Improves Belt Grinder

An automatic feed table is a feature of a wet belt sander manufactured by the Porter-Cable Machine Company of Syracuse 8, N. Y.

The feed table is moved to a position to the right of the machine, away from the belt, when loading and unloading special fixtures. When loaded the table is



Porter-Cable surfacer

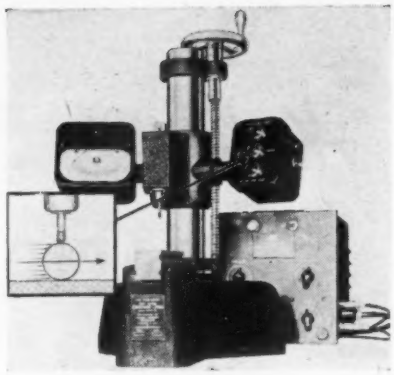
moved to the left; a trip engages the control lever and the hydraulic feed automatically advances the table toward the belt. A micrometer stop halts the operation when the desired size is reached.

The automatic table has been designed for use with the BG-8 Porter Cable surfacer.

Federal Products Electronic Comparator Gages in One Pass

The model 130 electronic comparator gage with sensitivity ranges of 0.006 to 0.0002 in. is a product of the Federal Products Corp. of 1144 Eddy St., Providence 1, R. I. In this instrument, variations in the position of the mechanical contact point are magnified by an electronic circuit and indicated by either indicator dial or limit lights.

The indicator dial is used to deter-



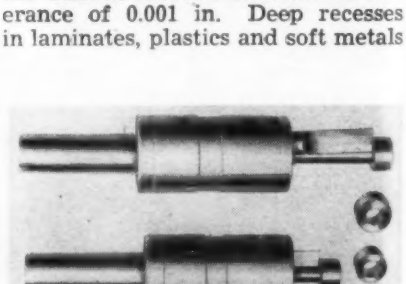
Federal electronic gage

mine specific dimensional variations and to set the gage. Any one of the three indicator lights tells the status of the inspected part: green is acceptable; red is oversized and yellow is undersized. One master is required and it need not be the exact dimension specified. If the gage block or master is within 0.003 in. of the required dimension the gage can be set to the specified dimension. The contact pressure can be set from 16 to 1½ ounces to gage soft materials. Maximum throat depth is 4¼ in. Reference anvil is 4½ in. by 1⅜ in.

PML Single Bit Counterbores Are Adjustable to 0.001 Inch

PML counterbores with pilots in sizes from ¼ in. to 1 in., with straight or tapered shanks, are supplied by the Precision Mechanical Laboratory of 119 West 63rd Street, New York 23.

The adjustable feature allows the bit to be reset, after grinding, to the desired recess size within a tolerance of 0.001 in. Deep recesses in laminates, plastics and soft metals



PML counterbores

may be cut at high speeds, without withdrawing the tool, because the single bit design affords high chip clearance.

Any desired contour can be ground on the bit end for concave, convex and other desired contours.

GUARD YOUR COSTS AS WELL AS YOUR WORK WITH *Stellite!*

FOR TOUGH GAGING JOBS

5 TO 20 TIMES LONGER SERVICE!

Next time you order thread plug gages, specify Cadillac Stellite . . . Cadillac for quality and precision, Stellite for long life and economy.

On hundreds of production jobs where highly abrasive materials have been inspected, Cadillac Gages made of Stellite have consistently given 5 to 20 times the service of the best steel gages previously used.

Stellite is extremely resistant to abrasion. It has an unusually low coefficient of friction. It is basically a different material from the materials that are inspected. For these reasons the inspection operation is accomplished with less drag on the gage and consequently with less expansion of the gage due to frictional heat. And because its coefficient of expansion is near that of steel, Stellite gages may be used in different shops under different temperature conditions with the same accuracy as with steel gages.

Next time you have a particularly tough gaging job, try Cadillac Stellite Gages and see how they guard your production costs as they guard the quality of the work you do. Write TODAY for prices and complete details.

Cadillac

GAGE COMPANY

20316 HOOVER ROAD · DETROIT 5, MICH.

Fellows gear checker

Fellows Gear Checker Inspects Tooth Taper, Cone and Spacing

An inspection instrument that can be converted quickly from the checking of cone measurements to the checking of tooth spacing and tooth taper is manufactured by the Fellows Gear Shaper Company of Springfield, Vermont.

This instrument is provided with an automatic indexing device which indexes for each tooth as the operating lever is returned after each check. It has a capacity for gears up to 12-in. pitch diameter.

General Electric demagnetizer

General Electric Announces New Line of Demagnetizers

The General Electric Demagnetizers are intended for demagnetizing machined parts, thus releasing adhering particles and chips, as well as to adjust and stabilize the magnetic flux in permanent flux assemblies.

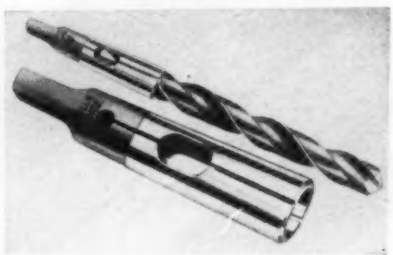
The design permits non-magnetic conveyor belts to be run through the apparatus for continuous operation.

They are available in 4-in. capacity for 115 volt, 60 cycle operation, and in 8- and 12-in. capacity for 220/440 volts from the Special Products Division, General Electric, Schenectady.

Positive Drive for Shankless Drills by Scully-Jones Chuck

Scully-Jones and Company of 1901 South Rockwell Street, Chicago 8, are manufacturing a drill chuck designed for holding the shankless drills produced by the Republic Drill and Tool Co. of Chicago.

Seven sizes of drill chucks, from No. 1 to No. 5 Morse taper are required for driving the 135 sizes of shankless drills, from ¼ in. to 2 in. There are seven additional chuck sizes provided to convert this range of drills to an oversize shank series.



Shankless drill chuck

The Scully chuck is furnished with a Morse taper outside and a straight hole the diameter and length of the neck of a shankless drill. The neck engages two opposed driving flats for a positive drive.

Goggles Breathe to Eliminate Condensate in Fog-Free Type

The Fog-Free goggle harnesses normal breathing as a ventilating pump to prevent clouding of the lense. Normal inhalation draws a complete change of air across the lens about once every four seconds. This action prevents the natural moisture forming on the lens. The pressure of exhalation closes the inlet valve and opens the outlet in the base of the nosepiece.

The goggle has been developed by the Polaroid Corporation and the H. L. Bouton Company of Buzzards Bay, Mass., is the manufacturer.

Fog-Free goggle

DeVilbiss spray gun

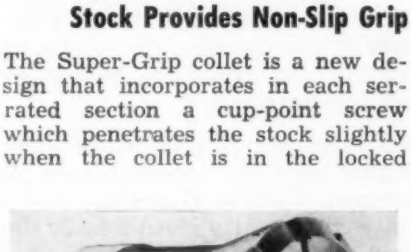
DeVilbiss Spray Gun Handles Industrial Cleaning Solvents

The DeVilbiss Company of Toledo, Ohio, manufactures a pressure feed spray gun especially designed for degreasing and cleaning operations on castings, forgings and sheet metal. Operated from a pressure feed tank, the gun handles commercial solvents and cleaners, producing a heavy atomized spray that removes dirt and greases.

Shaped to fit the hand comfortably, this gun has a two-finger trigger to reduce fatigue. When the trigger is pulled only part way back, air is emitted, permitting the gun to be used for dusting and drying.

Super Grip Collet for Rough Stock Provides Non-Slip Grip

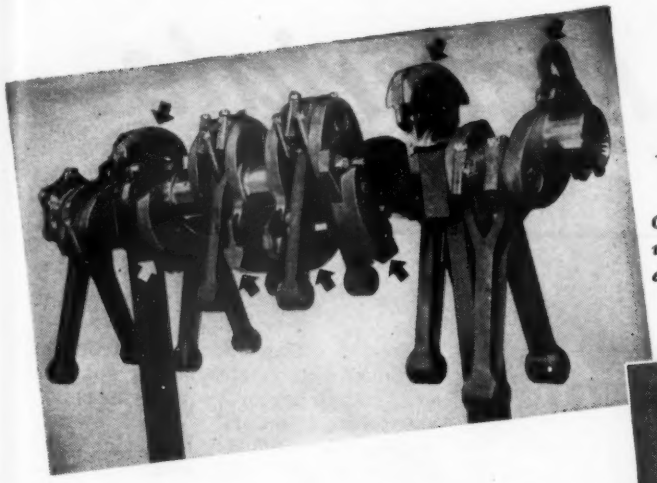
The Super-Grip collet is a new design that incorporates in each serrated section a cup-point screw which penetrates the stock slightly when the collet is in the locked position. The cup point can be adjusted to the penetration desired, or turned away completely, without removing the collet from the machine.



Super-Grip non-slip collet

The Super-Grip collet is effective for handling hot-rolled steel and on jobs where heavy tool thrusts cause slippage of conventional serrated collets.

It was designed for holding stock sizes of 2 in. and larger by the manufacturer, Sheffer Collet Company, Traverse City, Michigan.



Crankshaft of Ranger twelve-cylinder inverted V-type inline engine with connecting rods in place, showing (arrows) Needle Bearing equipped counter-balances.

Needle Bearings Carry Crankshaft Counter-Balance on Ranger Aircraft Engines

Dampener assembly. One bolt is secured through Torrington Needle Bearing, while second bearing is held in place for insertion of second bolt, completing assembly.

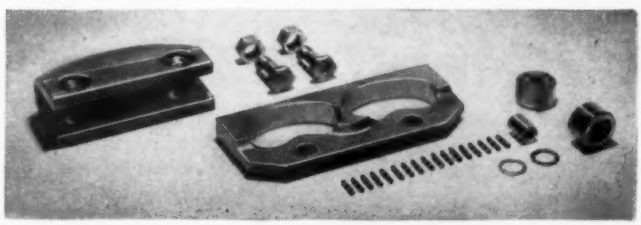
Here is an interesting application of Torrington Needle Bearings—a "cam-follower type" application—in the design of the crankshaft counter-balance of the Ranger twelve-cylinder, inverted V-type inline aircraft engine.

Two modified Type FT Needle Bearings are used to support each counter-weight, which in turn serves as a vibration dampener to provide dynamic balance on the crankshaft at high speeds.

Here again the characteristic advantages of Needle Bearing design are readily apparent: their high unit capacity due to the large number of small diameter rolls: their comparatively small O.D.; and the simplicity of their installation make them ideal for this and many other applications where dependability and long, maintenance-free service life are essential.

Perhaps these features will suggest an application where you can use Needle Bearings to improve efficiency, increase service life or effect cost economies through simplification of design or production steps.

Remember—there's a type and size Torrington Needle Bearing to meet virtually every requirement. If you haven't the latest information on file for ready reference, send today for our combined catalog and application handbook, No. 30-A.



Dis-assembled view shows counter-weight parts, and detail of the modified Type FT Needle Bearing.

THE TORRINGTON COMPANY

TORRINGTON, CONN. • SOUTH BEND 21, IND.

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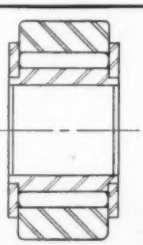


The FT Torrington Needle Bearing designed for Heavy Rolling Loads

TORRINGTON NEEDLE BEARINGS

Parts and Materials

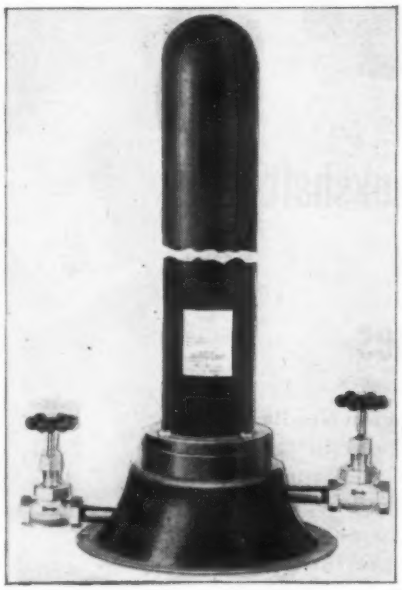
Weave Increases Elasticity Of Taylor Phenolastic Fiber

Fabric-base phenolic fiber has been given greater elasticity by a special weave in the base material of the fiber and rearrangement of the resin formula and coating procedures to form Phenolastic fiber for post-forming laminates. According to the manufacturer, Taylor Fibre Co., Norristown, Pa., the material can be formed within 3 min. to almost any bend, curve or draw desired. Among the advantages claimed are fast production, and lower die costs.

Weldco Steam Jet

Weldco Jet Improves Steam Absorption Heating Systems

The new Weldco steam jet for heating pickling and rinsing tanks maintains constant circulation of tank solutions by the Venturi effect of the tapered collar incorporated in the design. It is claimed that uniformity of solution resulting from the constant circulation will reduce pickling costs. It is weld-fabricated of Monel by the Youngstown Welding and Engineering Company of Youngstown, Ohio.



Deoxo Gas Purifier

Deoxo Gas Purifier Operates At Normal Room Temperatures

The Deoxo Gas Purifier, utilizing metallic palladium as a catalyst, is designed to operate at room temperature. It requires no pre-heating or after-cooling for its operation. Gases with less than 20 parts of oxygen impurity in a million parts are obtainable at the maximum flow rate. The unit requires no maintenance and it is also claimed to last indefinitely when used with cylinder gases.

Two unit capacities, one of 200 cu. ft. per hr. and one of 1,000 cu. ft. per hr., both operating at pressures up to 50 lb. per sq.in., are manufactured by Baker and Company of Newark, New Jersey.

Ro-Trol Relay Works Under Severe Vibration, Heat and Humidity

Ro-Trol rotary relay, manufactured by Price Bros. Co., Frederick, Md., is designed for applications involving severe vibration, temperature and humidity. The basic unit is a compact driving mechanism providing up to 30 deg. of clock-wise or counter-clockwise rotation. When used to operate switch wafers, it makes a relay providing contact arrangements adaptable for spaced-wafer switches or switches in separate compartments. Where switch wafers are not used, a special self-contained coil break switch is provided. The unit measures 2½ × 1½ × 1¾ in.

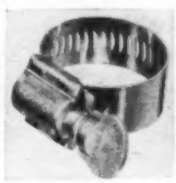
G-M Multiple-Coil Breaker Protects Three Varied Circuits

Either a.c. or d.c. circuits can be protected with a multiple-coil circuit breaker, available from G-M Laboratories, Inc., 4300 N. Knox Ave., Chicago 41, Ill. The breaker can be equipped with as many as three separate coil windings to make a single unit adaptable for protecting equipment that operates on different voltages.

In addition to acting as a resettable fuse, the breaker also serves as a manual switch since it is equipped with a pushbutton. The coils may be so designed that tripping can occur on overloads of three widely separated values from as low as a fraction of an ampere to as high as 70 amp. Each winding has an independent terminal connection for each circuit to be protected. Weight is approximately 9 oz.

Stainless Steel Aero Seal Hose Clamps Resist Corrosion

Aero Seal hose clamps, produced by Aircraft Standard Parts Co., 1727 19th Ave., Rockford, Ill., intended for corrosion resistant service, are described as lighter, thinner, stronger and more flexible than carbon steel ones. A mechanically interlocked saddle permits elimination of welds.



Aero Seal hose clamp

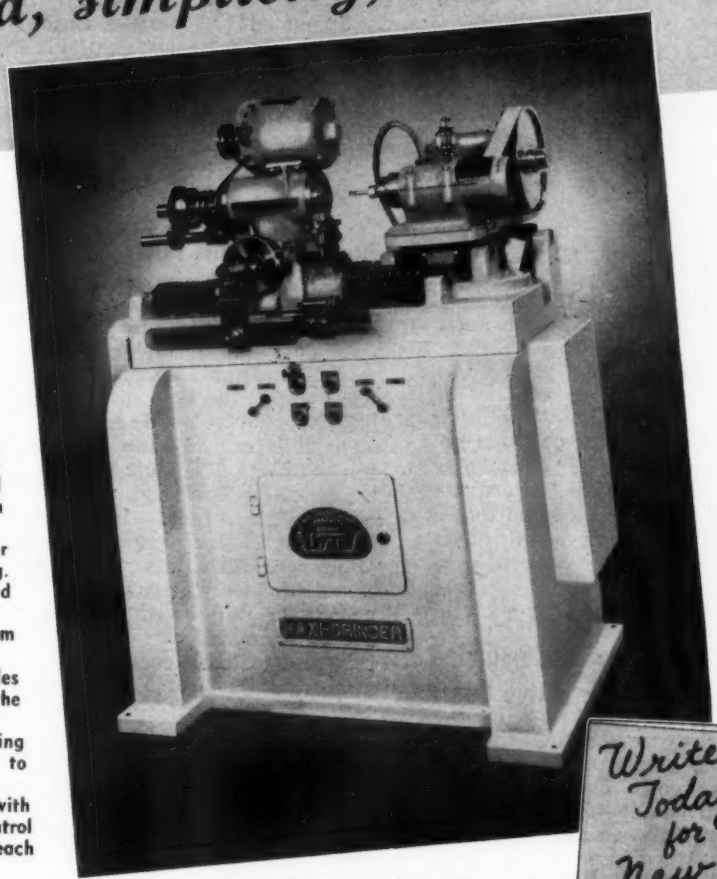
Present production is of sizes M12, M16 and M20 and the manufacturer has expressed intention gradually to increase the line to include all nominal sizes from ½ in. through 4¼ in.

NEW! DIFFERENT!

A GREAT STEP FORWARD IN INTERNAL GRINDER DESIGN!

AMAZINGLY ACCURATE!

New Maxi-GRINDER features Unusual Design . . . Developments offer combined speed, simplicity, wide range



These features make the Maxi-Grinder outstanding as a fast, precision internal grinder:

Grouping of operating controls is such that operator's right hand is free to load and unload work.

Closing and opening of collet is entirely automatic . . . operated with a cam and lever arrangement.

A motor driven mechanical differential unit drives the ram in which the grinding spindle is mounted . . . positively eliminates bell-mouth holes. Length of stroke is easily adjusted, making it adaptable to grind shoulder and blind holes; has six speeds, can quickly be slowed with speed control switch for wheel dressing.

Diamond wheel dresser has a micrometer feed, quickly adjusted for automatic hole sizing.

Hardened, ground and lapped ways are sealed against dust.

Feeding mechanism is absolutely free from backlash and is totally enclosed.

Setting up to grind taper and angular holes is simplified by use of a built-in sine bar on the work head (see above close-up).

Dust collecting system draws off all grinding dust, prevents clogging, glazing and adds to wheel life.

All functions are performed mechanically with electric motor power and push button control . . . a separate motor being used for each operation.

Your copy of this new catalog will be sent immediately on request. Write . . . get acquainted with this newer, better method of internal grinding.

Write Today for New Catalog

WILSON MACHINE PRODUCTS DETROIT MP

TRADE MARK

Wilson Machine Products 1231 BEAUFAIT AVE. DETROIT 7, MICHIGAN

Drackett High-Impact Molding Material Has Been Announced

Drackett Co. 5020 Spring Grove Ave., Cincinnati 32, Ohio, has announced a high-impact molding material consisting of a phenolic compound and a specially cut high-strength cotton-cord filler. Characteristics of the material, based on standard ASTM tests, include: tensile strength, 6,700-7,400 psi.; flexural strength, 10,000-14,000 psi.; compressive strength, 28,000-32,000 psi.; water absorption, 24 hr., 1.7 percent; and, specific gravity, 1.41.

Tendency of the resin to flow away from the filler when the compound is under pressure has been reduced, increasing the ability of the material to flow through their sections.

Palnut Triple Grip Holds Nut Firmly in any Position

Featuring a triple grip, the Type 6NAO self-locking nut manufactured by Palnut Co., 65 Cordier St., Irvington, N. J., has jaws which close in around the bolt like the jaws of a chuck when the nut is tightened. Spring tension is also exerted upward on the bolt thread and downward on the nut base. A third grip is exerted on the bolt by the top portion of the nut. The spring tension will hold the nut in any desired position on the bolt regardless of vibration. The nut can be used on metals or on bolts holding together parts of glass, plastic and similar materials, where a resilient fastening is required that can be tightened without danger of fracturing these relatively brittle materials.

Self-locking nut

Plasteel Dry Drawing Compound Produces Protective Coating

No. 268 dry drawing and annealing compound, which is applied as a waxy, aqueous emulsion, is announced by the Plasteel Corporation, 3900 West Jefferson Ave., Ecorse 18, Mich.

Designed to be applied in either a drum or spray type mechanical washing machine at an operating temperature of 175 to 185 F., the compound is applied in varying strengths to give a very nearly imperceptible wax coating to clean pieces from the pickle line or from the wash.

The coating is described as containing sufficient annealing compound to prevent the formation of hard mill scale during anneal, producing instead a thin, porous protective scale that is easily removed in subsequent pickling.

Pieces can be drawn as they come from the washing machine, without the use of a coolant or added lubricant. If two draws in sequence are desired, residual compound is generally sufficient to make a second application unnecessary.

Tinnerman Floating Cage-Type Speed Nut Ready in two Sizes

Two models of floating cage-type speed nut are announced by Tinnerman Products, Inc., 2041 Fulton Rd., Cleveland 13, Ohio: Model A6939, of brass and phosphor bronze, for use with standard 6-32 machine screws and Model A5939 of spring steel, for use with standard 6Z sheet metal screws. Both styles are available to fit panel thicknesses from 0.062 in. up, and require an 0.171 in. dia. clearing hole to attach. The nut can be made in larger screw sizes.

Speed nut

DuPont Aircraft Putty Does Not Flow or Sag on Vertical Surfaces

For filling dents and cracks between aluminum sheets forming aircraft wings, No. 228-711 flexible, high-adhesion aircraft putty has been developed by E. I. du Pont de Nemours and Co., Wilmington 98, Del. The putty displays no tendency to flow and does not sag on vertical surfaces. It is fast-drying, low in shrinkage and weighs about one-fifth less than conventional putties. Postwar, it is expected to find application such as the finishing of rough metal castings and railroad coaches.

Firestone Adhesive Bonds Rubber Strongly to Metal

Development of an adhesive for bonding synthetic rubber to metal, and for which is claimed a bonding strength hitherto unattained, has been announced by Firestone Tire & Rubber Co., Akron, Ohio. Brass plating of metals before bonding is eliminated and, in addition, more uniform adhesion than is possible with brass plating is provided.

Detrex Triad Facilitates Cleaning of Spray Booths

Triad PR, a protective coating for the sidewalls of both wet and dry spray booths, manufactured by Detrex Corporation, 13005 Hillview Ave., Detroit 27, Mich., makes clean-up possible simply by spraying with water or steam. In dry booths, the coating facilitates scraping off the paint.

Triad PR can be applied by either brush or spray gun and dries to a hard, white, dustless coating which improves visibility in the booth.

Paramount Felt Bobs Mounted Permanently on Steel Mandrels

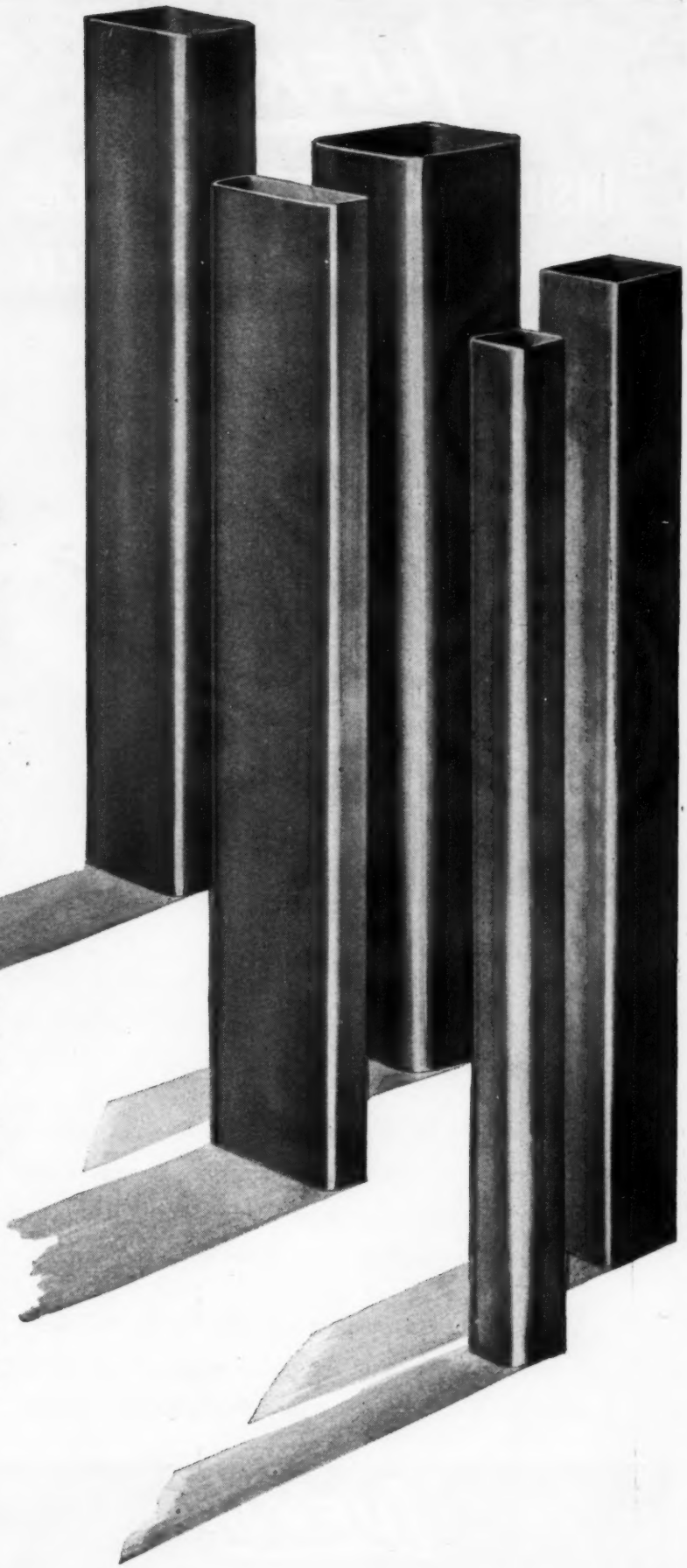
Paramount Brand felt bobs, manufactured by Bacon Felt Co., Winchester, Mass., are now available permanently mounted on ½ to ¼ in. steel mandrels. This is said to effect a saving in time, since the operator need but slip a new mandrel-mounted bob into place when the old one has worn out. Trueing and permanent attachment at the factory saves operator time.

Greer hydraulic accumulator

Greer Hydraulic Accumulators Available in Several Sizes

A hydraulic accumulator offered by Greer Products Corp., 39 West 60th St., New York 23, N. Y., is available for operating pressures up to 3,000 psi. in capacities of 1/3, 1, 2½, 5, 10 and 25 gal. For larger capacities, several units can be installed. Overall length ranges from 8-1/16 to 52⅝ in. and overall diameter from 4⅛ to 12¾ in.

Square and Rectangular Aluminum Tube ...by REVERE



Do you know that —

Revere makes other than round aluminum alloy tubes.

The quality and service established by Revere on round tubes is now available in square and rectangular shapes.

These tubes are now used chiefly in aircraft structural members. They combine lightness with strength and rigidity.

Square and rectangular tubes are drawn from round to provide physical properties that meet specifications for either the S-O (soft) or the S-T (heat-treated) condition.

Dies are available for a wide range of sizes and shapes. New designs may be created to meet new engineering needs.

Eventually, when metal and facilities exceed the needs of war, these tubes will have many important uses in products for civilians. Remember Revere's extensive experience in working aluminum to the most exacting military standards when planning for the future. For full information, write Revere Executive Offices.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

Executive Offices: 230 Park Ave., New York 17, N. Y.

LUFKIN

INSIDE MICROMETER CALIPERS

FOR BETTER BALANCE AND FEEL

Any toolmaker would be proud to own a set of Lufkin Inside Micrometer Calipers. For taking exact inside measurements they surely do the job.

Light-weight, rigid measuring rods fit onto either or both ends of micrometer head. Thus you may center the head to maintain proper balance and "feel", and also have it in position for easy reading.

Lufkin Inside Micrometers are built for the toolmaker who demands the best. Available in sizes from 1-1/2" to 40". See them at your dealer's. Write for free catalog.

LUFKIN

SAGINAW, MICHIGAN · NEW YORK CITY

TAPES · RULES · PRECISION TOOLS

TRADE PUBLICATIONS

Abrasive Wheels—Card chart containing an analysis of Norton grinding and diamond wheel markings. Norton Co., Worcester 6, Mass.

Air Control Equipment—Two circulars give a detailed description of Marton hand-operated air control units. Smallpiece, Ltd., Beverly, Mass.

Air Express—A pamphlet of facts and figures gives distance, time and cost of air express. Railway Express Agency, Inc., 230 Park Ave., New York 17, N. Y.

Arc Welders—Booklet contains descriptive specifications of units for automatic or manual production welding. Glenn-Roberts Co., 2107 Adams St., Indianapolis 1, Ind.

Automatic Control—A "Primer," contains details of the Man-Au-Trol principle of automatic control of machine tools used for drilling, boring, turning, facing, reaming and other operations. The Bullard Co., Bridgeport, Conn.

Bearings—An illustrated folder containing details of ball and nut screw bearings, with specifications and maximum compressive load ratings. Saginaw Steering Gear Division, General Motors Corp., Saginaw, Mich.

Book Catalog—Technical books of many branches of science and industry are listed in a new catalog now available. The Chemical Publishing Co., 26 Court St., Brooklyn 2, N. Y.

Boring Machines—Folder with detailed specifications and floor plan dimensions of Covel boring machines. Covel Mfg. Co., Benton Harbor, Mich.

Broach Sharpening Machines—Bulletin C52-44 covers broach-sharpening machines for flat and round broaches, with specifications. Colonial Broach Co., Detroit, Mich.

Cam Milling—A variety of cam-milling set-ups including the rotary table, dividing head, dummy templets, and rotary head milling machine are described in an illustrated booklet. Kearney & Trecker Co., Milwaukee 14, Wis.

Castings—Illustrated folder on the characteristics of beryllium-copper castings. The Beryllium Corp. of Pennsylvania, Reading, Pa.

Clutches—Two illustrated folders describing slip and overload release

HOW ARE SUBSTANTIAL SAVINGS ACHIEVED BY GRINDING WITH A CRUSH DRESSED WHEEL?

IS GRINDING TIME REDUCED?

Yes! On the Sheffield Precision Thread and Form Grinder with a crush dressed multi-ribbed wheel, grinding time is often reduced as much as two-thirds.

DOES CRUSH DRESSING PROVIDE A BETTER CUTTING SURFACE?

Yes! Crush dressing removes whole grains from the wheel leaving a multitude of effective cutting edges whereas diamond dressing cuts across the grains leaving flats which do not cut but do increase generation of heat.

IS CRUSHED WHEEL DRESSING FAST?

A full form can be crushed into a wheel on the Sheffield Precision Thread and Form Grinder by the special crushing device, in a fraction of the time required by conventional dressing methods. Intricate profiles requiring hours by diamond dressing, can be crushed into a wheel in a few minutes. After the original crushing of a wheel, recrushings or redressings take only a few seconds.

DOES CRUSH DRESSING REDUCE DRESSING TOOL COSTS?

The Sheffield Corporation introduced and pioneered crush dressing in this country and found from several years' experience that wheel dressing costs by this method on many jobs are considerably less than for diamond dressing. Many dressings are possible with the crusher roll—and a large quantity of parts can be produced from one wheel dressing.

CAN CRUSH DRESSING BE USED ON A SURFACE GRINDER?

Fixtures used in mounting crusher rolls on standard surface grinders for crushing wheels to produce flat profiled work, have been developed and pioneered by the Sheffield Corporation. Sheffield engineered surface grinders incorporating crush dressing equipment as an integral part are available.

WHERE CAN CRUSHER ROLLS BE OBTAINED?

Stocks of crusher rolls for producing threads in standard pitches are maintained in stock for immediate delivery. Rolls for coarser pitch threads and for all other types of forms can be obtained from Sheffield.

WHERE CAN FULL INFORMATION BE OBTAINED?

Details on crusher rolls for immediate delivery, surface grinder crusher roll mountings, the Precision Thread and Form Grinder for producing circular formed and threaded parts and the Micro-Form Grinder for producing crusher rolls and other profiles will gladly be sent by the Sheffield Corporation, Dayton 1, Ohio, U. S. A.

Advertisement by the Sheffield Corporation

Check these Features of

VICKERS

Variable Delivery PISTON TYPE PUMPS

Among the features indicated below are many of the reasons for the high overall mechanical efficiency and the high volumetric efficiency of Vickers Variable Delivery Piston Type Pumps. Also, the inertia forces of the rotating parts are minimized . . . the cylinders are arranged axially permitting more compact design.

Write for new Bulletin 43-11 which includes description of construction, operation and types of controls, installation drawings, performance characteristics, installation and operating instructions of Vickers Variable Delivery Piston Type Pumps.

VICKERS *Incorporated*
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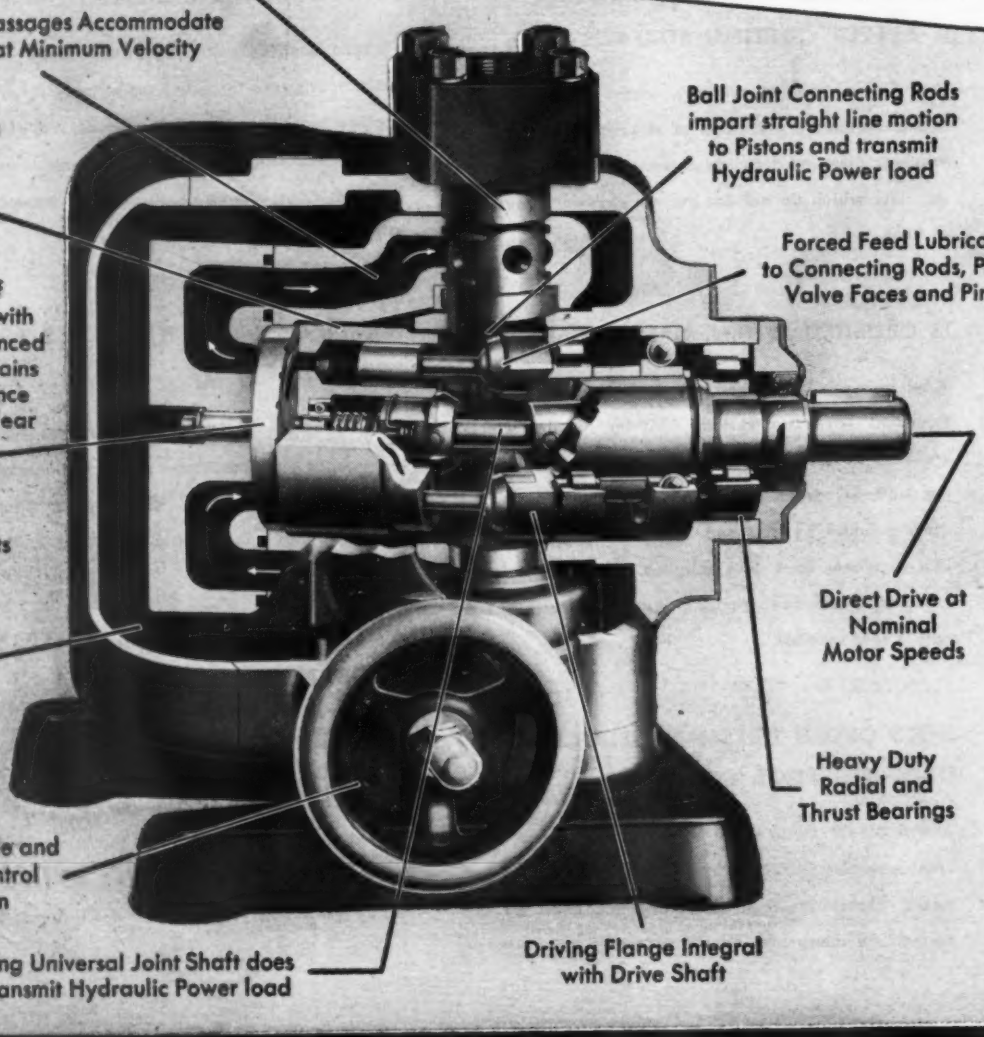
Application Engineering Offices
CHICAGO • CINCINNATI • CLEVELAND • PHILADELPHIA • LOS ANGELES
DETROIT • NEWARK • ROCHESTER • ROCKFORD • TULSA • WORCESTER


Hydraulically Balanced Pintles
Large Oil Passages Accommodate Oil Flow at Minimum Velocity
Multiple Cylinders Arranged Axially
Valve Plate of Ball Race Steel, with Hydraulically Balanced Valve Face Maintains Optimum Clearance and Minimizes Wear
All Working Parts Submerged in Continuously Circulating Oil
Interchangeable and Optional Control Mechanism
Floating Universal Joint Shaft does not transmit Hydraulic Power load
Ball Joint Connecting Rods impart straight line motion to Pistons and transmit Hydraulic Power load
Forced Feed Lubrication to Connecting Rods, Pistons, Valve Faces and Pintles
Direct Drive at Nominal Motor Speeds
Heavy Duty Radial and Thrust Bearings
Driving Flange Integral with Drive Shaft

There Are More Than 5,000 Standardized VICKERS Units For Every Hydraulic Power and Control Function

clutches. A complete catalog will also be furnished upon request. The Hilliard Corp., 204 W. Fourth St., Elmira, N. Y.

Compressors — Bulletin L-685-B1 has detailed illustrations and specifications on gas engine compressors up to 300 hp. Worthington Pump and Machy. Corp., Harrison, N. J.

Conveyors—Catalog No. 308, a reference book for all conveyor needs, with tables for selection of proper types. Standard Conveyor Co., No. St. Paul, Minn.

Cowl Fasteners—Illustrated folder describes Camloc cowl fasteners and grommets and contains a list of tools used for inserting them in surfaces. Camloc Fastener Corp., 420 Lexington Ave., New York 17, N. Y.

Cranes-Portable—Catalog No. 58, of 24 pages, contains specifications of the Krane Kar for transporting loads of one to ten tons. Silent Hoist & Crane Co., Brooklyn 20, N. Y.

Die-Casting Machines—Bulletin tells of a high-pressure die-casting machine, the HHP-1, for zinc, tin and lead. Other types are also listed. Lester-Phoenix, Inc., 2711 Church Ave., Cleveland, Ohio

Dies—Combined catalog of rolled thread dies and handbook of screw thread rolling. Rolled Thread Die Co., 237 Chandler St., Worcester 2, Mass.

Dust and Spark Suppressors—Five illustrated bulletins dealing with the suppression of dust, fumes and sparks in industrial plants. Whiting Corp., Harvey, Ill.

Face Shields—Catalog describes the "Hundred Series" of face shields. Safety Division of The Boyer-Campbell Co., 6540 Antoine St., Detroit 2, Mich.

Fluid Handling Equipment—Catalog features a complete line of suction and pressure line strainers, remote valve control assemblies and interceptors for grease, wax, fats, oils and solids. J. A. Zurn Mfg. Co., Erie, Pa.

Fractional Horsepower V-Belts—Folder with conversion chart and price list describes V-belts for fractional horsepower applications. B. F. Goodrich Co., Akron, Ohio.

Friction Sawing—A 32-page booklet reviews high-speed bandsaws, machines and methods for cutting soft, hard and sheet steel, non-ferrous metals, plastic, glass and other materials. The Tannewitz Works, 301-325 Front Ave., N.W., Grand Rapids 4, Mich.

Gages—A 112-page catalog of steel cylindrical plug and ring gages and

TURNER PLAST-O-LOCK

(Patent Applied For)

GAUGE SAYS STOP

on its NOT GO member!

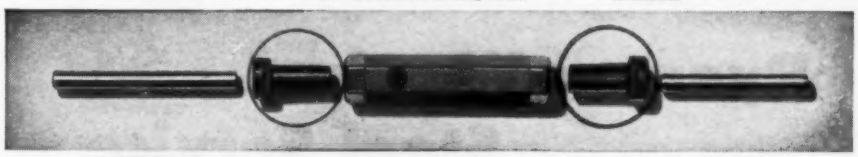
Here's another first by Turner—a *red* plastic collet to more quickly identify the "not go" member of your plug gauges! Plast-O-Lock gauges are great time savers wherever they are used.

Turner's Plast-O-Lock (patent applied for) collet type plug gauges are not only easier to use but they will multiply the life of plug gauges many times. The reason for this is obvious. Because Plast-O-Lock features a collet of plastic, slotted and tapered to fit into the tapered end of a standard plastic handle, it is possible for the gauges to be held securely without their surfaces being scratched or burred, thereby allowing use of most of the gauge's length. For example, as the "go" and "not go" ends are worn beyond allowed tolerances they are simply cut off, thus leaving an unused end ready for gauging. To illustrate further, if a boring no deeper than 1/8" is being checked, as many as 8 fresh gauging sections may be obtained from one standard length "go" gauge as furnished with Turner's Plast-O-Lock. This obviously eliminates the necessity of salvaging used gauges.

For full particulars about Plast-O-Lock gauges wire or write us today.

★ Features ★

1. Multiplies the life of the plug gage.
2. Collet will not mar a lapped or polished surface.
3. Used with plastic handle the gauge has a more sensitive feel in the hands of an inspector.
4. Is easy to make length adjustment because slot is provided for end wrench.
5. Plast-O-Lock size range from .050 to .690.
6. Red plastic collet for quick identification of "not go" members.



TURNER BROTHERS

DELIVERY Fast delivery can be made on these Plast-O-Lock gauges as well as the following Turner gauges: ring, flush pin, snap and built up.

TURNER GAUGE GRINDING COMPANY
2625 HILTON ROAD • • • • FERNDALE, MICH.

Sizes AVAILABLE

Plug Size Range	Length of "Go" Gauge	Length of "No Go" Gauge
.050 to .099	1 7/8	1 3/8
.100 to .149	2	1 1/2
.150 to .199	2 1/4	1 3/4
.200 to .249	2 1/2	2
.250 to .499	3	2
.500 to .690	3 1/2	2 1/2

HOW TO ORDER PLAST-O-LOCK

1. Diameter.
2. Length of gauging surfaces.
3. Tolerance or accuracy.
4. Hardened alloy steel or chrome, tungsten carbide or Nor-Bide.
5. Number of members—Go, Not Go, Handles.
6. Complete marking instructions.

Quick Steel from Warehouse Stocks Speeds War Effort

It would be difficult to measure even a fraction of the man-hours gained each week through prompt delivery of steel in large and small quantities from local warehouse stocks. But this service of the nation's steel warehouses has been handled so smoothly that the work, though highly essential, is virtually taken for granted.

Repairs are made without delay, new construction completed quickly, production lines kept moving by these fast steel shipments. In addition steel from stock often makes possible quick changes in design to meet urgent battle needs. The time saved by this service makes every warehouse shipment—thousands daily—of vital importance. *(See Advertisement.)*

Ryerson Wartime Steel Service

Prompt Deliveries from 11 Plants

Ryerson stands for steel quickly from stock—and has since our Company was founded 102 years ago. Now eleven strategically located Ryerson Steel-Service Plants serve the nation's principal steel-using areas—anything from a single piece to many carloads—bars, shapes, structurals, plates, sheets, tubing, etc.—carbon, alloy, Allegheny Stainless and tool steel.

At present our service cannot always be as fast nor our stocks as complete as under normal conditions. Nevertheless, stocks are large and deliveries generally satisfactory.

Our latest stock list describes our complete line—more than 10,000 kinds, shapes and sizes of steel. This buying reference is a veritable "book of knowledge." It gives descriptions, sizes, weights, specifications and cutting extras for every kind of steel. Our nearest plant will be glad to furnish you a copy.
JOSEPH T. RYERSON & SON, Inc., Steel-Service Plants: Chicago, Milwaukee, Detroit, St. Louis, Cincinnati, Cleveland, Pittsburgh, Philadelphia, Buffalo, New York, Boston.

RYERSON STEEL

setting disks, also carboloy gages and tools. Lincoln Park Industries, Inc., Lincoln Park 25, Mich.

Gas-Cutting Tips—A 12-page bulletin explains two new high-speed gas-cutting tips and contains charts and tables. Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.

Granite Surface Plates—Pamphlet tells of the master and standard series of black granite surface plates of fixed or portable units. State Mfg. & Construction Co., Franklin, Ohio.

Grinders — Illustrated folder describing the 4-in. Type C grinder with design features and specifications. Norton Co., Worcester 6, Mass.

Grinding—Booklet contains a wide variety of typical examples of machining and finishing of flat surfaces by grinding, and includes an index of grinding wheel data. The Blanchard Machine Co., 64 State St., Cambridge, Mass.

Heat-Treating Furnaces — Folder describing electrode furnaces for hardening, tempering and annealing, with temperature ranges and other details. The A. F. Holden Co., New Haven 8, Conn.

Hot Metal Working—A 40-page booklet, "Metal Quality" is designed for users of forgings, instructors in engineering and metallurgy, design engineers, metallurgists and the metal-working industry. Drop Forging Association, 605 Hanna Bldg., Cleveland, Ohio.

Hot-Work Tool Steels—Bulletin #6 has information on applications, compositions and heat-treatments of hot-work steels. Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.

Lathe Handbook—Forty-third edition of lathe operators' handbook "How to Run a Lathe." South Bend Lathe Works, South Bend 22, Ind.

Lock Washers—Circular describing pre-assembled screws and lock washers. Shakeproof, Inc., 2501 No. Keeler Ave., Chicago 39, Ill.

Machine Bases—Four-page folder shows steel fabricated bases for use in the construction of bases, columns or frames of machine tools. Central Boiler and Mfg. Co., 5818 River St., Detroit 11, Mich.

Machine Tools—An 800-page illustrated bound volume of new and rebuilt machine tools. Simmons Machine Tool Corp., Albany, N. Y.

Manganese Steel Products—Amsco Bulletin No. 5 describes the uses of manganese steel products. American

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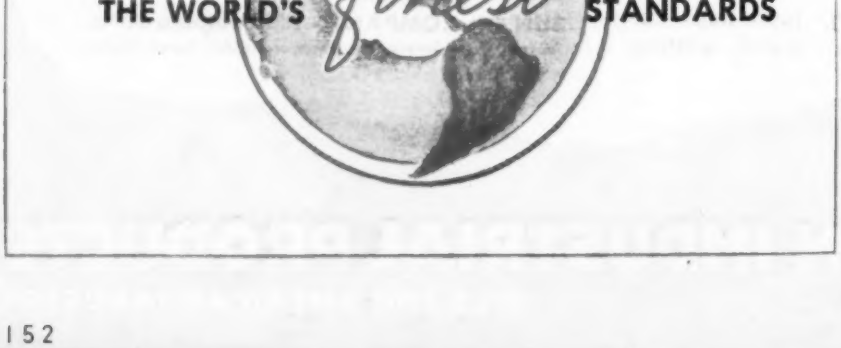

Manganese Steel Div. of American Brake Shoe Co., Chicago Heights, Ill.

Manufacturing Facilities—Folder soliciting inventions and high-precision products for postwar manufacture. Peerless Tool & Mfg. Co., 1133 No. Kilbourn Ave., Chicago 51, Ill.

Material Pumps—An eight-page bulletin covers high-pressure air pumps for handling paints, sealers and mastics. Stewart-Warner Corp., 1826 Diversey Parkway, Chicago, Ill.

Milling Cutter Data—A lose-leaf binder of case histories of field performances of milling cutters, rules for determining cutter speeds and feeds, clearance, rake angles and other information. Barber-Colman Co., Rockford, Ill.

Multiple Punches—Two illustrated bulletins describing multiple punches, from 150 to 1,000 tons, also spacing tables and tool set-ups. Thomas Machine Mfg. Co., Pittsburgh 23, Pa.

Multi - Purpose Machines—Illustrated 4-page folder "Tool Tips" describes various Ex-Cell-O multi-purpose production units. Ex-Cell-O Corp., Detroit 6, Mich.

Piston-Type Pumps—Bulletin of 28 pages explains the Vickers variable-delivery piston-type pumps as a source of hydraulic power. Vickers, Inc., 1400 Oakman Blvd., Detroit 32, Mich.

Plastics—Illustrated booklet containing data on plastics based on cellulose derivatives. Hercules Powder Co., Wilmington, Del.

Pressure Vessels—Bulletin describing various types of pressure vessels, piping and heat exchange equipment. American Locomotive Co., Alco Products Division, 30 Church St., New York 8. N. Y.

Printing and Developing—Machines for making black-on-white prints and developing units are described in a 30-page booklet. Charles Bruning Co., Inc., 4700 Montrose Ave., Chicago 41, Ill.

Product Design—Illustrated booklet "Design for Profit" Product Designers, 230 No. Michigan Ave., Chicago 1, Ill.

Quenching—Reprint of an article on the development and application of the salt bath quenching processes. Ajax Electric Co., Inc., Frankford Ave. at Delaware Ave., Philadelphia 23, Pa.

Radiant Heating and Cooling—Bulletin No. 33, Part II, of "Radiant Heating and Cooling," including thermal environment and radiant heating. Cornell University Engi-

neering Experiment Station, Ithaca, N. Y.

Radii Charts—A folder describing charts for production checking and inspection purposes and optical projection screens for comparator use. Gage Co., Battle Creek, Mich.

Reamers—Illustrated folder describing "Diamond Blue" reamers. Pratt & Whitney, West Hartford 1, Conn.

Rust—Causes and prevention of rust are covered in a 74-page booklet, subdivided into eight chapters. E. F. Houghton & Co., Philadelphia, Pa.

Safety Clothing—Booklet describing safety clothing for male welders. American Optical Co., Southbridge, Mass.

Shop Trucks and Lifts—A 76-page catalog, No. 22, has special sections on floor, lift and power fork trucks, cranes, stackers and storage racks and special equipment for jobs in production. Lewis-Shepard Co., 300 Walnut St., Watertown, N. Y.

Springs—A 12-page illustrated folder describing springs for varied applications with design data and physical properties. American Locomotive Co., Railway Steel Spring Division, 30 Church St., New York 7, N. Y.

Stainless Steels—Folder containing characteristics of Registal stainless steels. Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.

Steel Castings—Brochure devoted to the steel castings industry of America. Steel Founders' Society of America, 920 Midland Bldg., Cleveland, Ohio.

Steel Stamps—Folder contains data and prices of steel letter and figure stamps for industrial plants producing precision machine products. The Acromark Co., 7-13 Morrell St., Elizabeth, N. J.

Surface Grinders—Precision surface grinders and component parts are described in an illustrated booklet, which includes the types having hand feed, mechanical feed and a combination of both. Reid Brothers Co., Inc., Beverly, Mass.

Surface Testing—A 20-page catalog of the Profilometer and accessories for measuring surface roughness. Physicists Research Co., Dept. 1, Ann Arbor, Mich.

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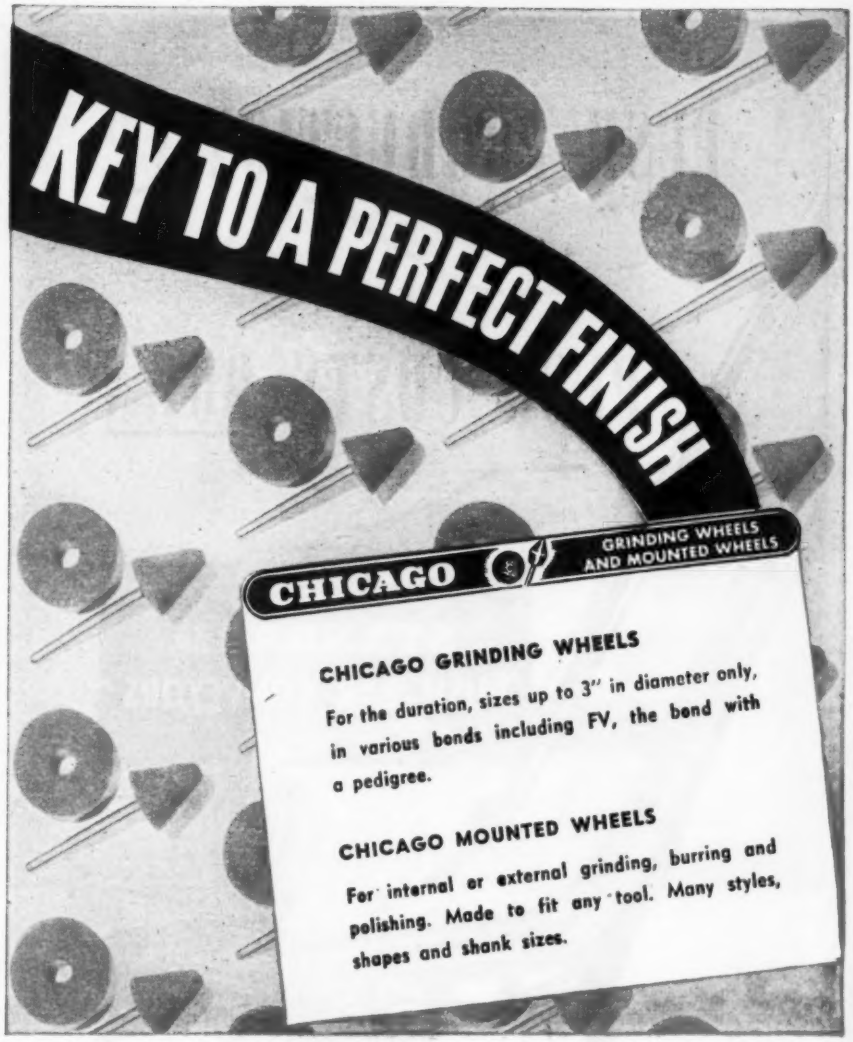
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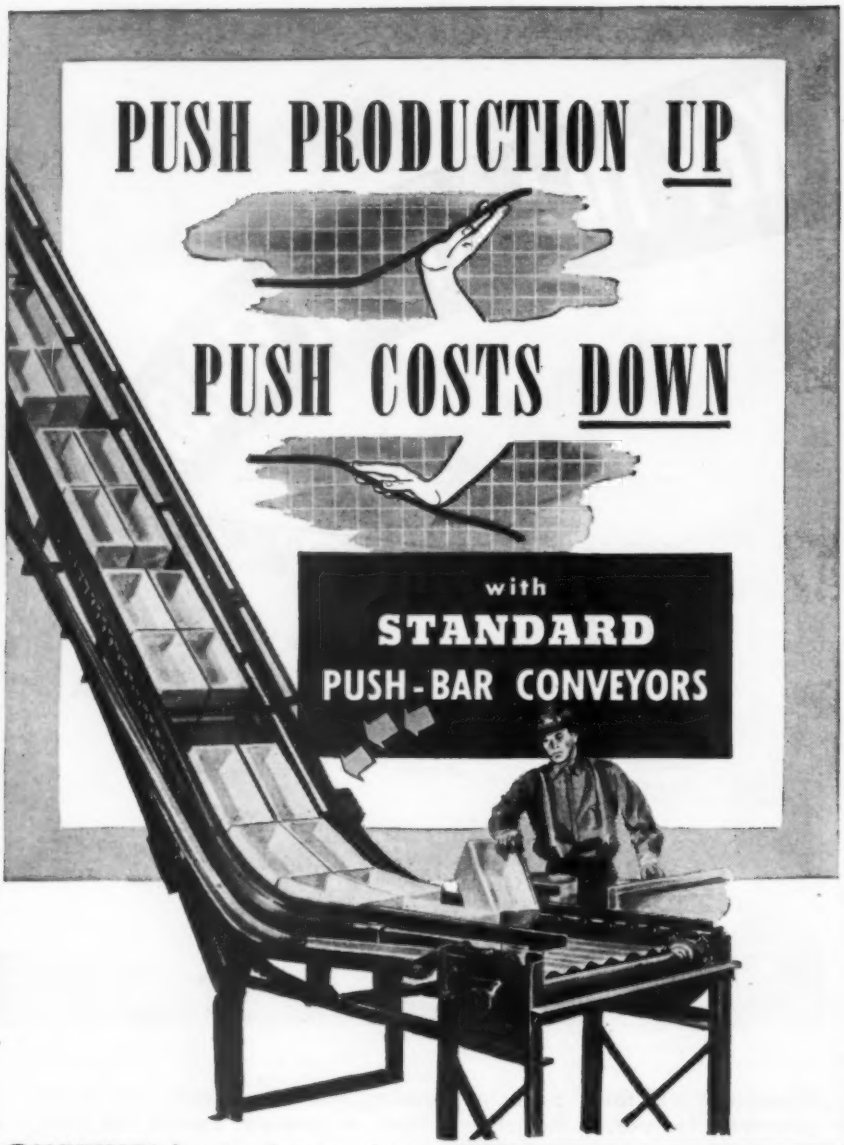

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acetylene welding and cutting. The Linde Air Products Co., 30 East 42 St., New York, N. Y.

Tool Catalog—A 116-page catalog of seven sections covering standard and special machine shop tools. Request on company letterhead. Lake Shore Tool Works, 816 No. Kostner Ave., Chicago 51, Ill.

Vibration Indicator—Pamphlet No. GEA 4140 describes instruments for measuring displacement, and a velocity meter for measuring displacement or velocity of vibration, with the range of each instrument shown. General Electric Co., Schenectady, N. Y.

Vinyl Resin Products—A 16-page illustrated catalog of industrial products made of Compar, a solvent-proof vinyl resin. Resistoflex Corp., Belleville, N. J.

NEW BOOKS

METALS AND ALLOYS DICTIONARY—*By M. Merlub-Sobel, consulting chemical and metallurgical engineer. Published by Chemical Publishing Company, 234 King St., Brooklyn, N. Y. $4.50.*

Over 10,000 terms are defined in this book. If a material is defined, the composition, properties and uses are given. Proprietary metals are identified with respect to maker. Other pertinent information are the physical constants and properties of chemical elements, and descriptions of machinery and processes employed in metallurgy.

As a dictionary of terms plus short descriptive paragraphs in many instances, the book should be of interest to many concerned with the applications and peculiarities of metals, alloys and raw materials.

•

SCREW MACHINE PRODUCTS DATA BOOK—*Published by The Eastern Machine Screw Corporation, New Haven, Conn. 15 cents.*

Prepared to assist companies in the design of screw machine products for new items or equipment, this data book carries the reader through the basic considerations, as definition and advantages of screw machine products, to selection of material and details of design.

Technical considerations of selection of screw threads and of the class of thread fits, the use of threaded rods and the nature of drawings and specifications are presented in detail. The book is illustrated with photographs and scale drawings.

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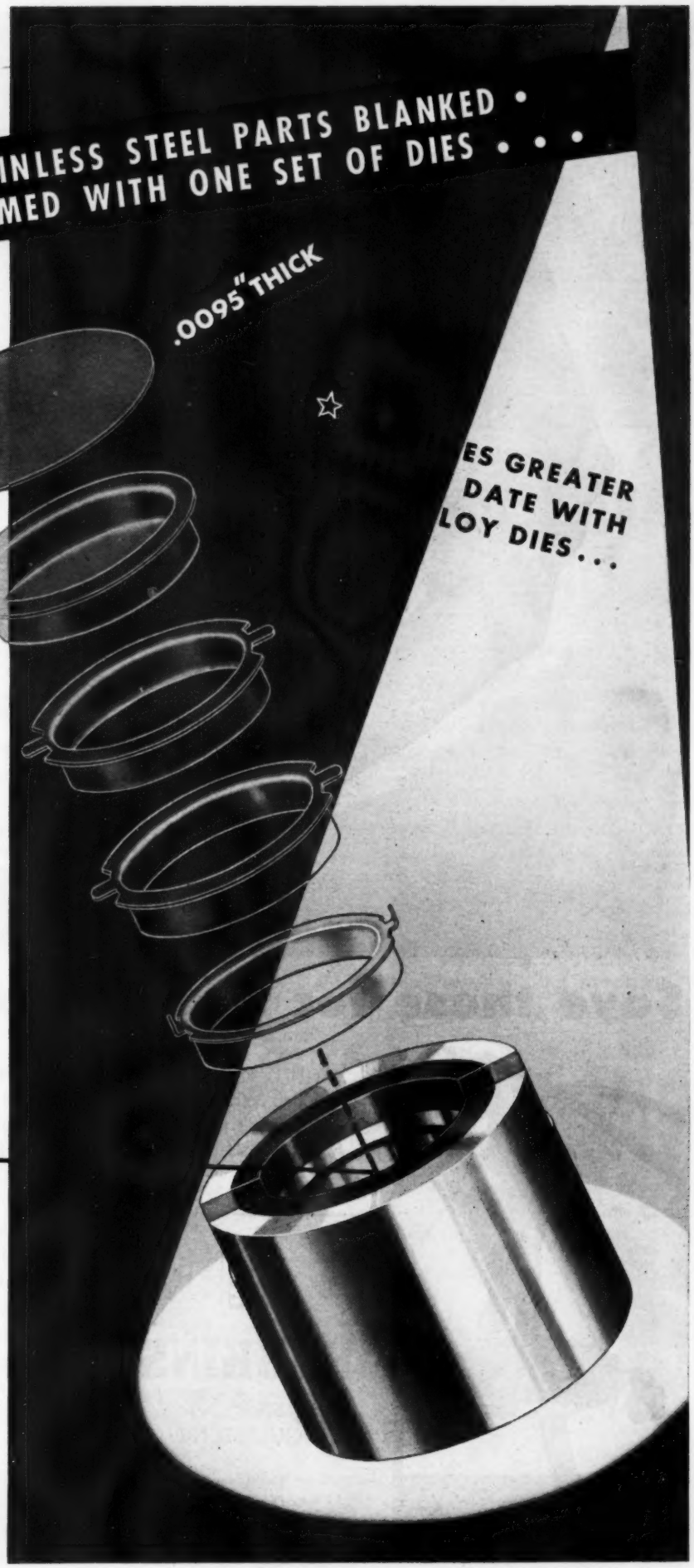

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3 Reduces breakage to an absolute minimum

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5 Speeds crib service reducing non-productive waiting time of workers and machines

6 Reduces tool clearance time of departing employees to a fraction of a minute

7 Definitely records employees' responsibility for tools, preventing disputes when tools are returned or workers quit

8 Is operated with minimum crib personnel; inexperienced attendants of either sex trained in about one shift

9 Is easily installed in busiest cribs and plants; initial investment and operating expense quickly repaid

10 Provides for inspection and, when necessary, reconditioning of used tools before replaced in bins

11 Shows how long workmen retain tools; prevents keeping more than necessary at any time

12 Provides perpetual inventory and record of tool activity for elimination of obsolete tools and reduction of excessive inventories

13 Gives you facts justifying or denying necessity for tool purchases

14 Provides reliable data on life and comparative performance of brands and types of tools

15 Gives you accurate basis for allocation of tool expense to various departments

Your Tool Cribs Are CUSTODIANS of YOUR PRODUCTION EFFICIENCY

Here's an idea for every plant operating a tool crib, borrowed from a recent issue of Bell Aircraft Corporation's splendid house organ, *The Bell Ringer:*

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"The Tool Cribs are more than huge storehouses of vital equipment. Their personnel is more than a group of filing clerks and guardians over valuable property. They are the *custodians of production efficiency.*"

Tool Cribs operated with obsolete checking systems usually are gems of inefficiency. Missing tools create confusion and delay production. Employees waste time at the crib windows and the idle time of machines mounts up.

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McCaskey Systems Ltd., Galt, Ontario, Canada — *The McCaskey Register Co., Watford, England*

Reprinted from "DUREZ MOLDER"

Tapping Phenolics

As phenolic plastic molding materials are of an abrasive nature, it is good practice to use high speed nitrated and chrome plated taps having three flutes rather than the four commonly used. A negative rate of about 5 degrees on the front face of land will in some cases prevent binding of taps in the hole when it is backed out.

It is also recommended to use machine taps .002" to .005" oversize as these taps will produce more parts per tap. For example, a 6/32" screw diameter is .138". The standard tap diameters are minimum .1395" to maximum .1415". So if a tap should be to the minimum dimension, it will wear down to .138" in approximately 400 holes, making the hole too tight. If an oversized .005" tap is used, it is possible to produce at least 1200 holes per tap. From 65 to 75% of thread should be used.

Peripheral speeds for tapping phenolic molding materials are from 50 to 80 feet per minute.

It is important to countersink the holes larger than the diameter of the tap to prevent chipping around the threaded hole.

Air blasts concentrated on the tap operated by the stroke of the tapping head will help to clear the chips and act as a cooling agent, minimizing friction and overheating, which prolongs the life of the tap and results in greater production per tap.

IF YOU MUST TAP
Here's Good Advice
FROM DUREZ

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WHICH ELIMINATES TAPPING

Savings of 30% to 50% in time and labor costs are common when P-K Self-tapping Screws are adopted, because they *eliminate* tapping and tap expense.

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A P-K Assembly Engineer will help you, and you can be sure he'll recommend only the best type of Self-tapping Screw for the job, because Parker-Kalon makes all types. He'll call at your request . . . or, mail details for recommendations. Parker-Kalon Corp., 208 Varick Street, New York 14, N. Y.

TYPE "Z" THREAD-FORMING SCREWS
For fastening to cellulose acetate and nitrate compounds, methyl methacrylate resins, polystyrenes, molded and laminated phenolics, and metal. Forms a thread in the material.

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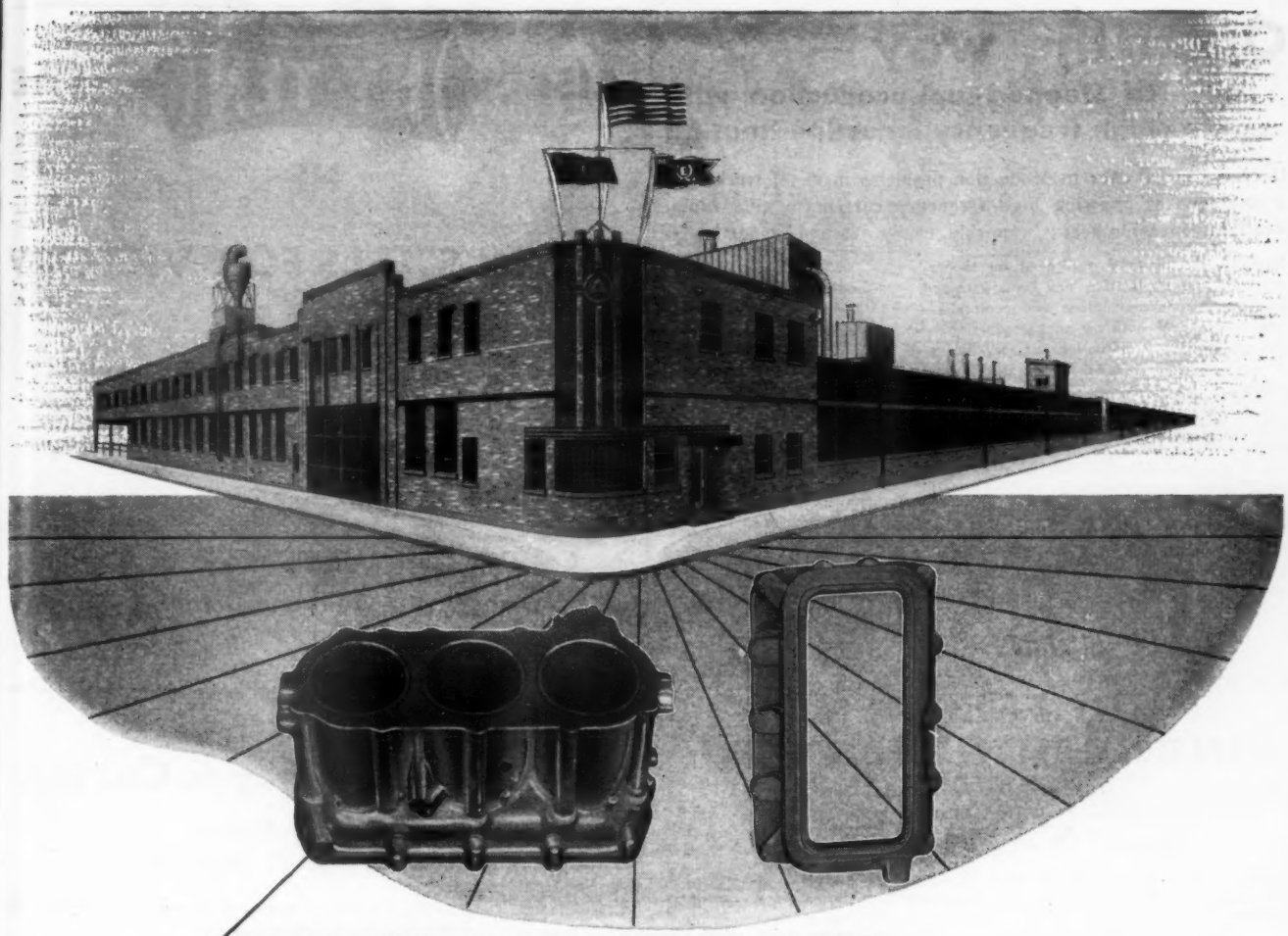

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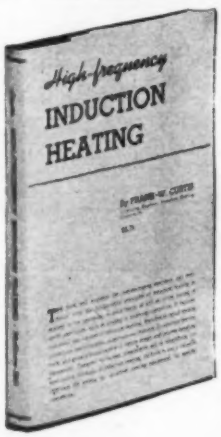

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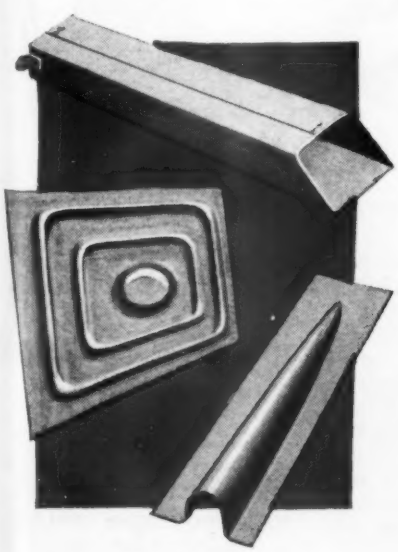

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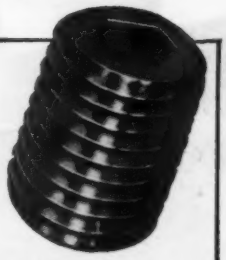

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Mac-it products include Socket Head Cap Screws, Hollow Set Screws, Hexagon Head Cap Screws, Square Head Set Screws, Stripper Bolts, Hexagon Socket Pipe Plugs. *All are made of alloy steel and heat-treated.*

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ROLL ON **ABBOTT** *Bearing* **BALLS**

CARRY THE LOAD WITH STAMINA PLUS

Uninterrupted performance is the norm established by Design and Production Engineers. . . . Each part, each unit must have stamina . . . to withstand the gruelling load . . . to deliver precision-planned performance. . . . Tough specifications, these—but daily met by ABBOTT BEARING BALLS. They have the "built-in" stamina to carry the load as planned.

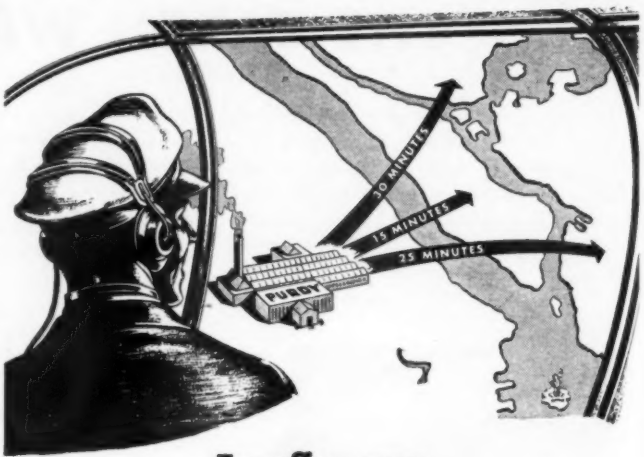
UNINTERRUPTED PERFORMANCE

SPECIFY "ABBOTT"

ROLL ON **ABBOTT** *Bearing* **BALLS**

THE ABBOTT BALL COMPANY HARTFORD 10 CONN. U.S.A.

PURDY'S MOVING TO JERSEY



To offer you more steels and faster deliveries

Any plant in Metropolitan New York can get deliveries on a huge variety of steels—in one day—from Purdy's new warehouse at Lyndhurst, N. J. 50,000 square feet housing a much greater inventory . . . a private railroad siding, plus the latest handling equipment, assure double-quick shipments. Call a Purdy sales engineer to help you crack tough problems of applications and methods.

A. R. Purdy Co.
INCORPORATED

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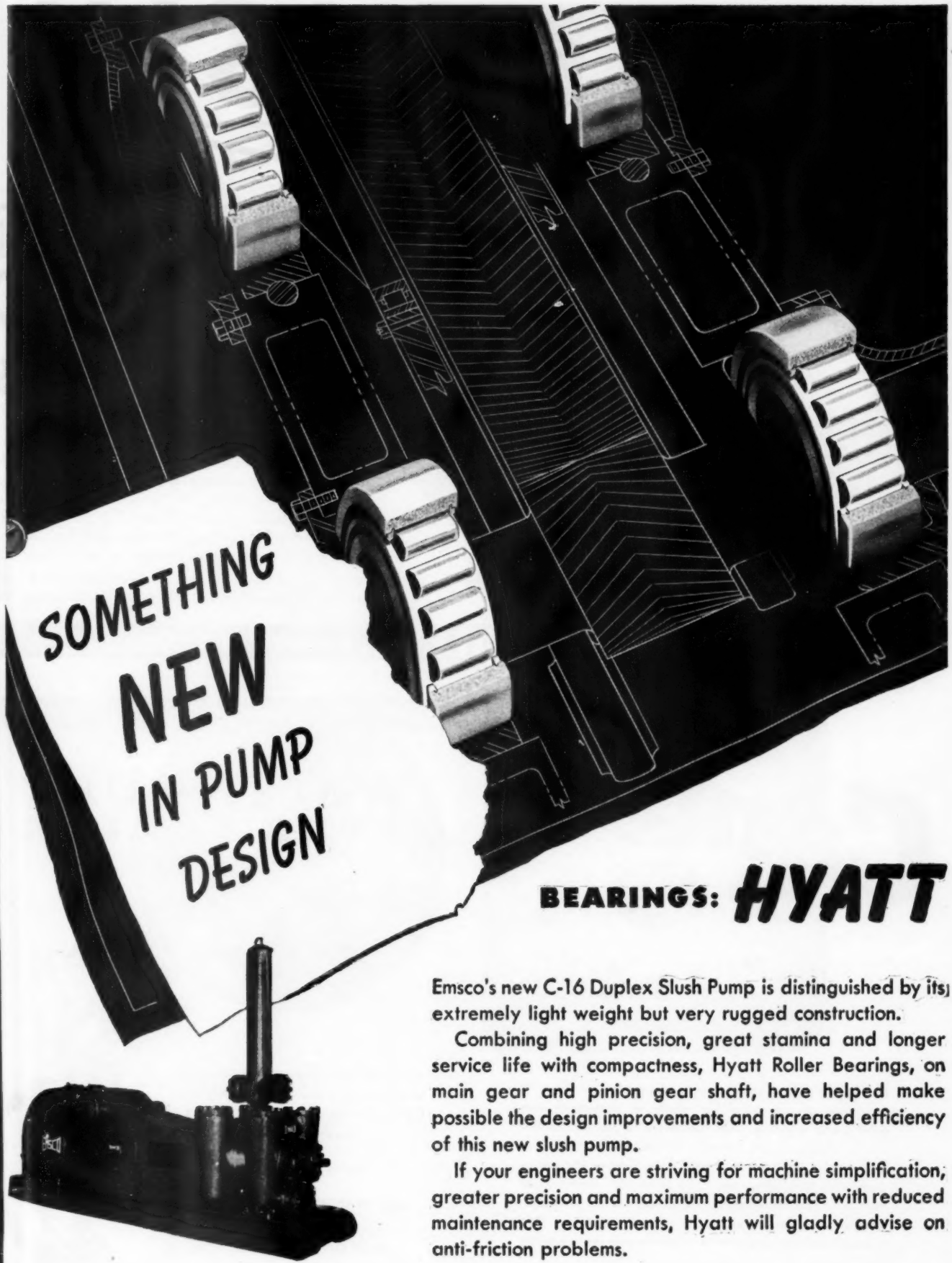
COLD FINISHED STEELS • TOOL STEELS
SPRING STEELS • TUBING • DRILL ROD
COLD ROLLED STRIP STEEL



BEARINGS: HYATT

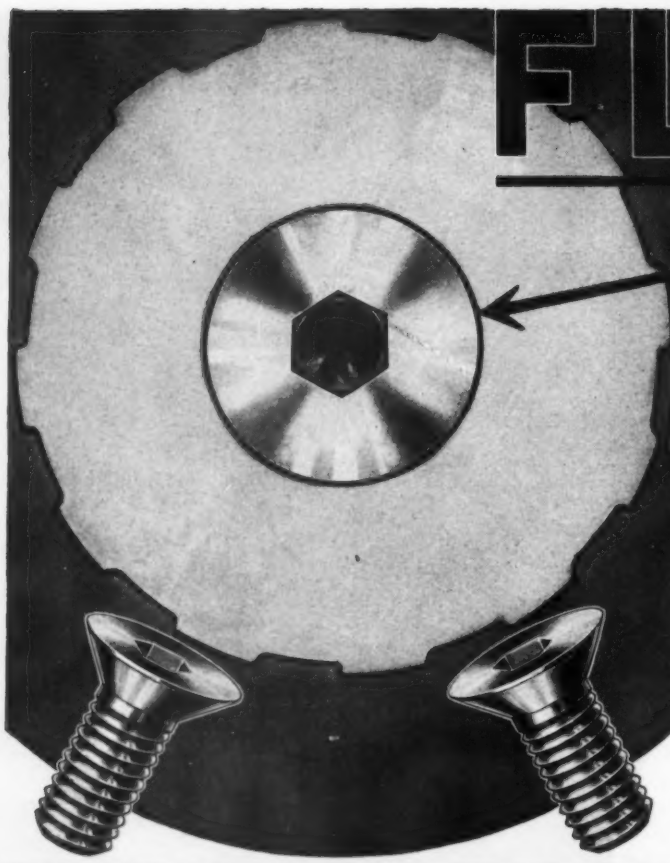
Emsco's new C-16 Duplex Slush Pump is distinguished by its extremely light weight but very rugged construction.

Combining high precision, great stamina and longer service life with compactness, Hyatt Roller Bearings, on main gear and pinion gear shaft, have helped make possible the design improvements and increased efficiency of this new slush pump.

If your engineers are striving for machine simplification, greater precision and maximum performance with reduced maintenance requirements, Hyatt will gladly advise on anti-friction problems.

HYATT BEARINGS DIVISION, GENERAL MOTORS CORPORATION
HARRISON, NEW JERSEY

FLUSH!



ALLEN FLAT HEAD Cap Screws

They set up in a counterbored hole more truly *flush* than any other type of hollow screw. The V-head fits the counterbore with complete *closed contact* all-round. This gives frictional holding-power and rigidity of grip... "Pressur-formd" of ALLENOY steel, with uncut metal fibres shaped to the head. Threads also *pressur-formd*, with tolerance held to a high Class 3 fit. Obtainable as a part of the ALLEN Line from your local Industrial Distributor. *Ask for samples* and dimensional data.

The Allen Mfg. Company ★ ALLEN ★ Hartford, Conn., U. S. A.

Cams

● **25 YEARS** of experience in making special cams for thousands of companies has made us experts at cam cutting and grinding. Our facilities and equipment, the most complete of any plant in the country, permits us to manufacture any style or size of Cam, Geneva Motion, or Scroll Plate in quantities of 1, 10 or 10,000. Accuracy can be held to split thousandths, and surfaces to micro-finishes. Send us specifications or blueprints and we will be glad to submit a detailed quotation to you on your requirements.

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3924-44 WEST HARRISON STREET · CHICAGO 24, ILLINOIS

WATERBURY STEEL BALLS

Uniform hardness which extends to center of ball. Highly finished. Carefully manufactured. Strong, sturdy, accurate.

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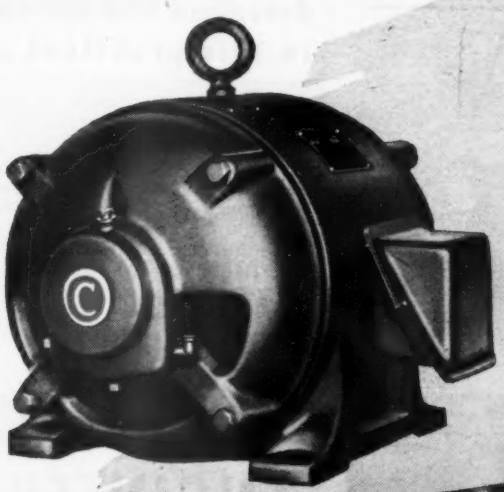
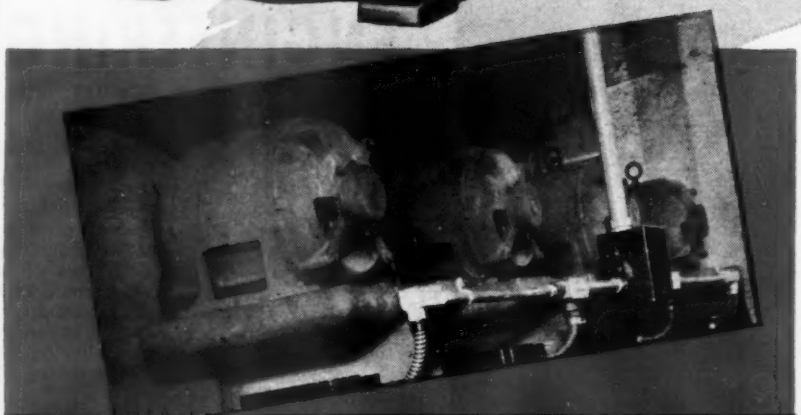
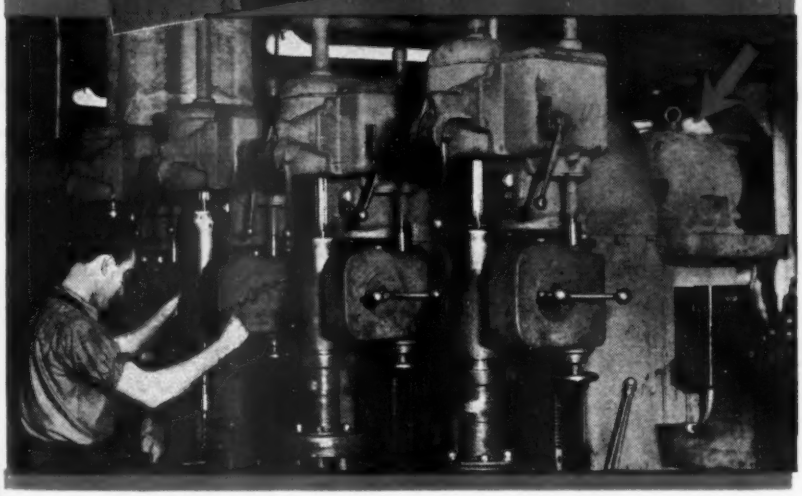
U. S. A.
MAIN OFFICE: POUGHKEEPSIE, N. Y.

MODERN CENTURY PROTECTED INDUSTRIAL MOTORS



Are an important part of production tooling to meet industry's *peacetime* demands for lower costs





The upper half of the Century Form J general purpose, open, continuous duty motor is closed to minimize the possibility of dripping liquids or falling solids entering the vital parts of the motor.

This added protection feature is made possible because of the scientifically designed Century mechanical ventilation system. All motors generate heat, so if the insulation is to have long life, the heat must be rapidly carried away from the windings. Two fans located behind each bearing bracket draw cooling air "IN" through the openings of both bearing brackets. This cooling air is deflected first around the bearings to keep them cool and then across the windings and to air passages between the outer surfaces of the magnetic core and the frame — the heated air being finally discharged "OUT" through the lower sides and bottom of the frame.

These modern, protected, industrial, general purpose motors meet the requirements of more than 80% of all polyphase motor applications. This Form J construction is at present available in 2 to 25 horsepower four-pole frame sizes.

Your Century Motor Specialist has full information and his wide experience may well prove valuable to you. Call him today.

Century C MOTORS

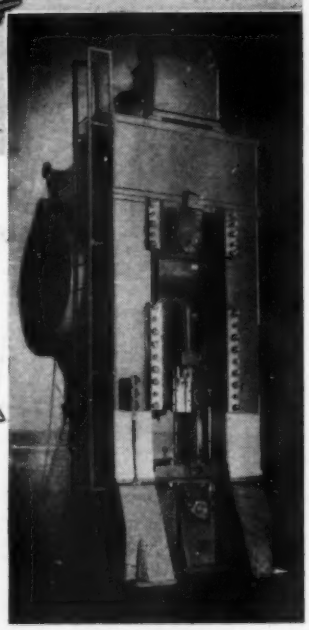
400

CENTURY ELECTRIC COMPANY, 1806 Pine Street, St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

Illustrated is a pitman from a 1500-ton Verson Knuckle Joint Press. This pitman is bronze-bushed with Ampco Metal.

PROTECTION
against breakdowns
at critical points...
WITH
Machine-tool parts of wear-resisting
AMPCO-METAL
M-13



• *Above:* 1500 Verson Knuckle Joint Press has knuckles lined with Ampco Metal. Shuttle operates on Ampco Metal strips which take full 1500-ton pressure.

A series of aluminum bronze alloys adaptable to varying operating requirements . . .

To protect you against costly "down time" for repairs due to metal failures, foremost machine tool builders (over 90 of them) standardize on parts of Ampco Metal.

This versatile alloy — made in five grades and a number of modifications — has physical properties that can be regulated to suit the application: Controlled hardness. High tensile and compressive strength. Stubborn resistance to wear, shock, impact, fatigue, "squashing out." Good bearing characteristics. *Lasts several times as long as ordinary bronzes.*

Check for parts of Ampco Metal, as a mark of quality in the machines you buy. And insist that replacement parts for your older machines be made of durable Ampco.

FREE! "File 41 — Engineering Data Sheets" illustrates and describes many applications using various grades of Ampco Metal successfully. Shows you why it's good business to check for parts of Ampco Metal in specifications of the machine tools you buy. Fill in the coupon below for your free copy.

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described and demonstrated in this practical manual

Here at last is a course in time study for those who do not have extended technical, mathematical, or industrial training. It starts at the very beginning and covers completely both the methods of time study and the background of machines and operations of industry the time study man must understand, in a practical, home-study treatment. The author of the book says, "Anyone who can rate 90% in answering these questions (appearing at the end of each chapter) would be able to take and hold a time study position in any industry."

TIME STUDY ENGINEERING

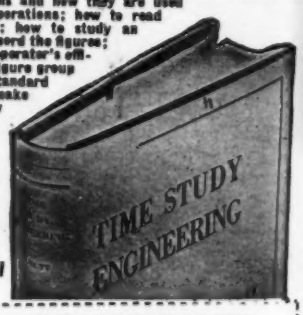
By WILLIAM H. SCHUTT
President, Detroit Time Study School, Inc.

130 pages, 6 x 9, 124 illustrations, $5.00

The book shows the whys and wherefores of time study work, reviews the arithmetic needed, tells step by step how to carry out a time study and gives a wealth of information on the machines and processes of industry, what the time study man should know about their construction and operation, and the special factors of taking time studies on each. Twenty-eight specimen studies on specific machines and operations are shown and fully discussed in the text.

- **gives 26 time-study charts; each from an actual observation in industry.**
- **describes machines and operations and their time-study factors.**
- **emphasizes factors of economical production and fair standards for the worker.**

Covers: Fundamentals of time study, requirements of work, equipment and how it is used, etc.; the basic motions and how they are used in analyzing operations; how to read the stop watch; how to study an operation and record the figures; how to rate the operator's efficiency; how to figure group bonus and standard hours; how to make process or flow charts, etc.



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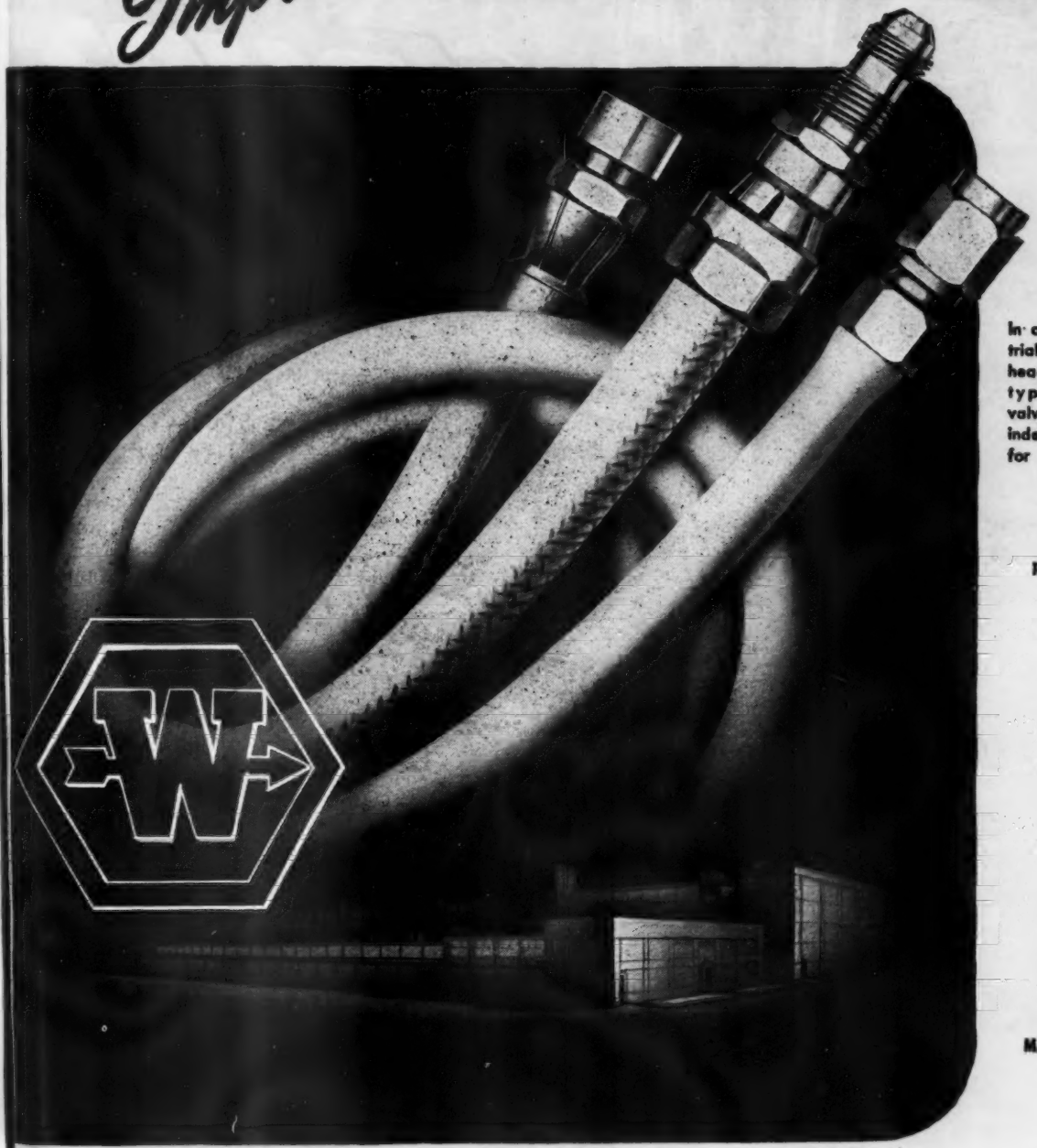

In addition to industrial hose, Weatherhead plants make all types of fittings, valves, hydraulic cylinders and other parts for these industries:

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New uses are being found daily for the application of our *improved* industrial hose lines on machinery of all kinds. We manufacture hose assemblies of all types to withstand pressures up to 10,000 P.S.I. They can be equipped with either permanent crimped ends or with re-usable, quick-attachable hose ends. For information or literature write or phone any Weatherhead branch office.

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TEXACO

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON SUNDAY NIG

PREVENTION

A "must" in processing Government-owned production equipment for storage. Texaco rustproofing products meet Government specifications for this purpose.

HIGH on the list of reconversion "musts" is protection against ruinous RUST for machines, precision tools and other production equipment made idle by termination of war contracts. If the equipment is Government-owned, contract specifications require that it be cleaned and processed *with minimum delay* after production ceases. If it is your own equipment, full protection of your investment naturally calls for equally prompt rustproofing precautions.

Ordnance Specification P.S. 300-4 for processing, packaging, packing and marking of production equipment gives exact specifications for rustproofing materials that must be used on Government-owned equipment. Texaco rustproofing products meet Government specifications. They are easily applied through the medium of brush, dip or spray, and provide a protective coating that will assure preservation for years.

Whatever your rustproofing requirements, a Texaco representative can render helpful service. Get in touch with the nearest of the more than 2300 Texaco distributing points in the 48 States, or write to The Texas Company, 135 East 42nd Street, New York 17, N. Y.

Rustproofing Products

METROPOLITAN OPERA BROADCASTS SATURDAY AFTERNOONS

What do you know about CHAIN?

WHEN SELECTING A DRIVE, DO YOU ALWAYS BEAR IN MIND:

1. Chain, looked upon as flexible gearing, may be used to transmit up to 5000 H.P. in a single drive.
2. The Morse Rocker Joint Silent Chain is probably the most efficient known means of transmitting power between shafts.
3. It is being successfully used for speeds up to 8000 R.P.M.
4. It has been used on commercial drives running above 8000 feet per minute.
5. Chain operates over toothed wheels and cannot slip. Thus it is suitable for timing, and is made to extreme accuracy.
6. It can connect two shafts on the same centers, as in the chain coupling, and up to almost unlimited center distance.
7. Its flexibility serves to cushion shocks or impulses.
8. Standard or duplex chain can be used between two or more shafts running in the same or opposite directions, and will maintain precise speed ratios.
9. Ratios may be readily changed.
10. In both silent and roller chain, special link forms are available, and both the standard attachments and many special attachments serve as conveyors.

SPROCKETS CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *Roller and Silent* **CHAINS**

MORSE CHAIN COMPANY • ITHACA, N.Y. • DETROIT 8, MICH. • A BORG-WARNER INDUSTRY

Of course, it isn't technically a plastic, but it is so near to it that we use the term to emphasize its use possibilities. Through various chemical treatments we build into or upon a cloth structure the characteristics of a plastic joined with the flexibility, strength and fabricating possibilities of cloth. Any kind of cloth from a fine cambric to burlap.

Think of these materials as "flexible plastics" in helping to solve your post war material problems. Do not confuse these and other Holliston processes with ordinary cloth finishing. We prepare cloth with special characteristics to serve special needs — functional or decorative.

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A cloth bound book is bound to be kept — bind your

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in HOLLISTON Book Cloth — durable, impressive, hard-to-soil, easy-to-clean.

Write for samples.

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SPECIAL FINISH

HOLLISTON special finish cloths meet special needs —

TRACING CLOTH — PHOTO CLOTH — RUBBER (PROCESSING) CLOTH — BOOK CLOTH — SHADE CLOTH — SIGN CLOTH — TAG CLOTH.

Cloth combined with special compounds, filled, impregnated, coated — to form a material with characteristics of a plastic and the flexible strength of a woven fabric.

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AIRCRAFT
COAL MINES
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FURNITURE
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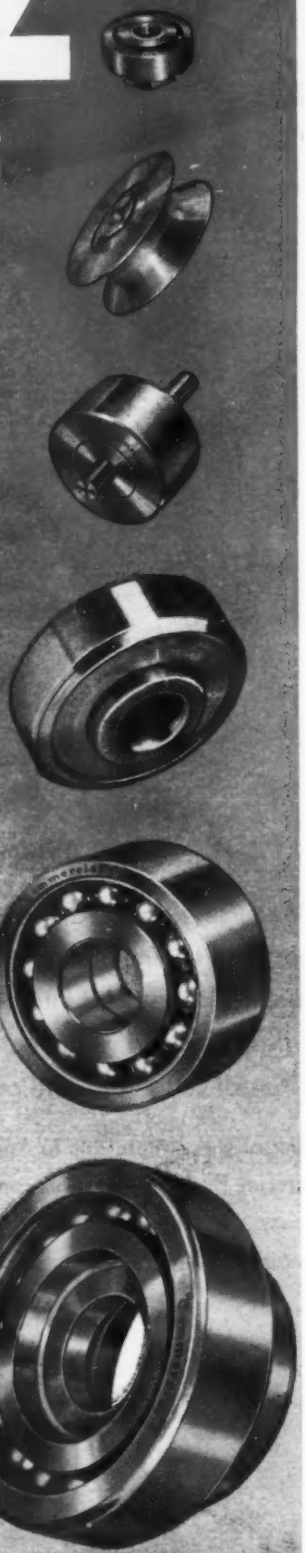
WASHING MACHINES
ROLLER SKATES
BABY CARRIAGES



WE manufacture ball bearings for hundreds of diversified products... from baby carriages to conveyor belts . . .

If you have a difficult ball bearing problem . . . the Schatz Engineering Staff will be pleased to cooperate...

Write for complete information.

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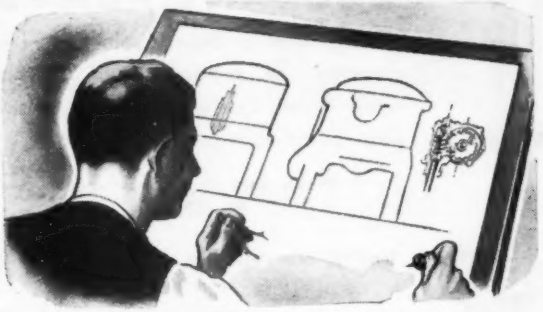
OUTPUT RAISER!

It puts a crimp in production to drive screws by hand . . . and then have to file off burrs. But that's what a certain washing machine maker *had* to do as long as he used slotted screws inside his tanks.

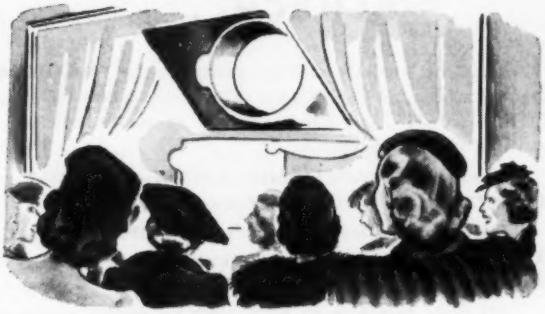
COST AMAZER!

But when he changed to Phillips Recessed Head Screws, he eliminated burrs. And no longer having driver skids to worry about, he switched to power driving . . . upped output tremendously . . . and got truly amazing cost-savings.



TRAIL BLAZER!

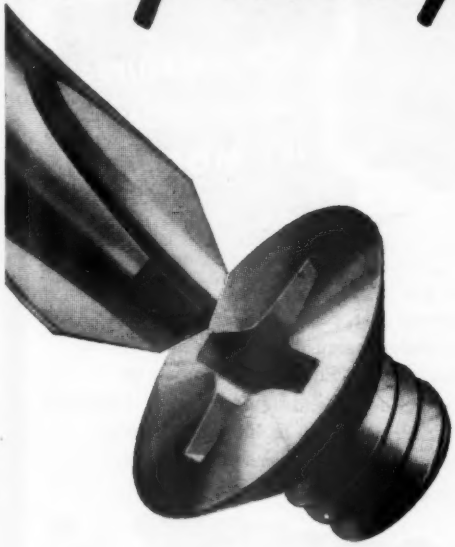
Besides reducing costs and speeding up production, use of Phillips Screws also shows up in product strength and rigidity. Screws with the Phillips Recess help designers plan . . . and get . . . much stronger, tighter fastenings.



COMPETITION FAZER!

Here's the final place where Phillips Screws give you an edge on competition. Any product with these better-looking, burr-free fastenings . . . that never disfigure surfaces or snag clothing . . . is just that much easier to sell!

It's Phillips — the engineered recess!



In the Phillips Recess, mechanical principles are so correctly applied that every angle, plane, and dimension contributes fully to screw-driving efficiency.

. . . It's the exact pitch of the angles that eliminates driver skids.

. . . It's the engineered design of the 16 planes that makes it easy to apply full turning power – without reaming.

. . . It's the "just-right" depth of recess that enables Phillips Screw Heads to take heaviest driving pressures.

With such precise engineering, is it any wonder that Phillips Screws speed driving as much as 50% – cut costs correspondingly?

To give workers a chance to do their best, give them faster, easier-driving Phillips Recessed Head Screws. Plan Phillips Screws into your product now.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

Made in all sizes, types and head styles

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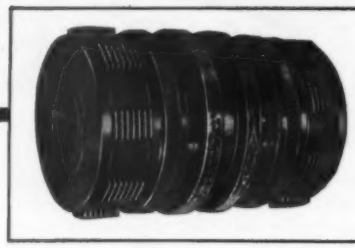
"MAXITORQ"



The FLOATING DISC CLUTCH . . .

Built for superior clutch operation, the **"MAXITORQ"** can be depended upon for duties where fast, smooth power pick-up is essential . . . where instant automatic release on overload is a vital requirement.

In addition, **MANUAL INSTALLATION — ASSEMBLY** and **ADJUSTMENTS** are made without the use of tools.

The patented features of the **"MAXITORQ"** Floating Disc Clutch principle include progressive developments that out-feature any similarly designed clutch.

All discs ride free of each other in neutral — you can see between them. No chance for re-engagement . . . no chance for drag and the consequent abrasion and heat.

Both wet and dry types are available, the former consisting of hardened and ground steel discs to be run in a lubricant, the latter of alternate discs of steel and self-lubricating bronze.

Clutch engagement is easily controlled by light pressure. Sleeve groove wear is reduced by use of non-metallic shoes.

SINGLE CLUTCH TYPE

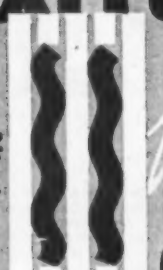
Made in both single and double clutches in capacities from ¼ to 5 H.P. at 100 R.P.M. Also in Pulley and Cut-off Coupling types.

New Catalog No. A32 on request. The Carlyle Johnson Machine Company, 52 Main Street, Manchester, Conn.

The CARLYLE JOHNSON MACHINE COMPANY
MANCHESTER, CONNECTICUT

•

MAXITORQ floating DISC CLUTCH



You can see between the discs

If the WAR SHOULD END Tomorrow

We would be most happy. Making every effort to increase vital production will bring an earlier peace.

GUSHER COOLANT PUMPS

have proven a dependable aid in increasing the production of machine tools. Install Gusher Coolant Pumps on your bottle-neck machines *NOW*.

Shown here is our new model HL-15025-B.

Send for new catalogue showing complete line of models.

MODEL HL-15025-B

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1809 READING ROAD CINCINNATI 2, OHIO
The "GUSHER"—A Modern Pump for Modern Machine Tools

WHEN YOU NEED PRECISION-BUILT SMALL PUMPS . . . Specify TUTHILL

Don't let its small size fool you. This internal-gear, rotary type, mechanically sealed pump does a man-sized job in pressure lubrication service. Equally outstanding for hydraulic mechanisms, fuel oil and liquid transfer. Capacities from .33 to 3 g.p.m. Pressures up to 400 p.s.i. Ring or foot-mounted. Many porting arrangements available. Write for Model L Industrial Bulletin.

Tuthill Pumps are serving Army Navy • Air Force • Merchant Marine and Industry

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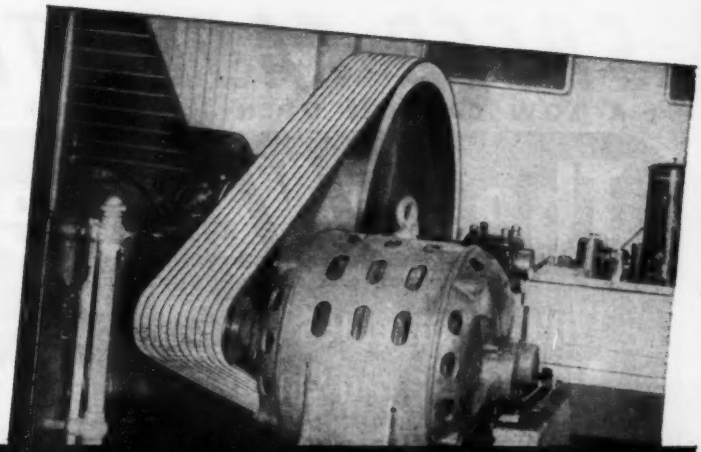

an important fact

GATES *Synthetic Rubber* V-Belts

—are *TODAY* Giving *BETTER SERVICE* Than *ANY* V-Belts Built *Before the War!*

and the Reason for it

When our Army's tanks, tractors and self-propelled big guns were being built, it was found that no V-Belts built by anyone before the war could stand the service that is now being delivered on the battlefield by V-Belts that Gates has developed especially for these heavy combat units. And Gates is building these V-Belts entirely of synthetic rubber.

* **The fact that Gates developed these belts—and is building them of synthetic rubber—is important to you now because every improvement developed by Gates for these Army belts has also been added, day by day, to the quality of the Standard Gates Vulco Ropes which are being delivered to you.**

As you know, wartime improvements in many other products must be withheld from general use until after the war is won—but victory depends so directly upon production, and production so directly upon V-Belts which drive the producing machines, that Gates has been able to give you immediately in your Standard Gates Vulco Ropes, every V-Belt improvement which Gates specialized research has developed for use on the Army's motorized equipment.

These are the simple reasons why you are finding that your Standard Gates synthetic rubber Vulco Ropes are today giving you better service than any V-Belts that were ever built before the war.

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Engineering Offices and Jobber Stocks in All Large Industrial Centers

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A LOW CARBON OPEN HEARTH PRODUCT

The *ONE* Steel

Which Combines
ALL These Advantages

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MINIMUM DISTORTION
GREAT CORE TOUGHNESS
REDUCED CARBURIZING TIME
INCREASED TOOL LIFE
GOOD TORSIONAL VALUES
GREAT IMPACT RESISTANCE
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SMOOTH FINISHED PARTS

SPEED CASE STEEL *will satisfactorily replace* **SAE X1314, X1315, B1112, B1113, X1020, 1115 and all comparable steels. It machines at 230 S.F.P.M. Increases production 50% to 75%. Reduces your inventory and is saving many users up to $69 per ton of steel used. USE SPEED CASE.**

Our Metallurgists are at your service

WRITE US FOR COMPLETE CATALOG

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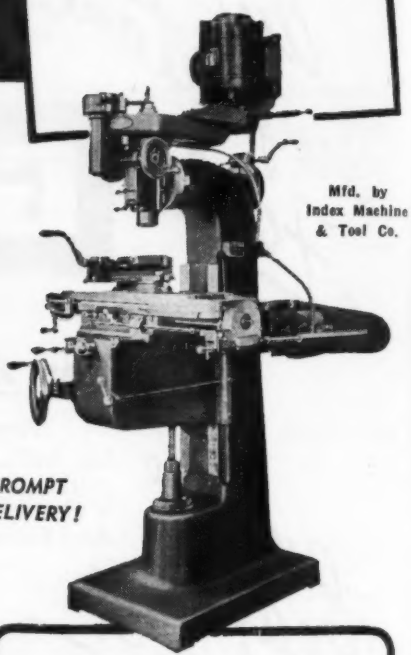

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A quality tool for precision work in the tool room or production line, incorporating such features as ball bearings—hardened and ground worm—quick acting throw-out for free hand turning—single movement table lock that does not cramp table out of alignment—compound trough. 12" size only.

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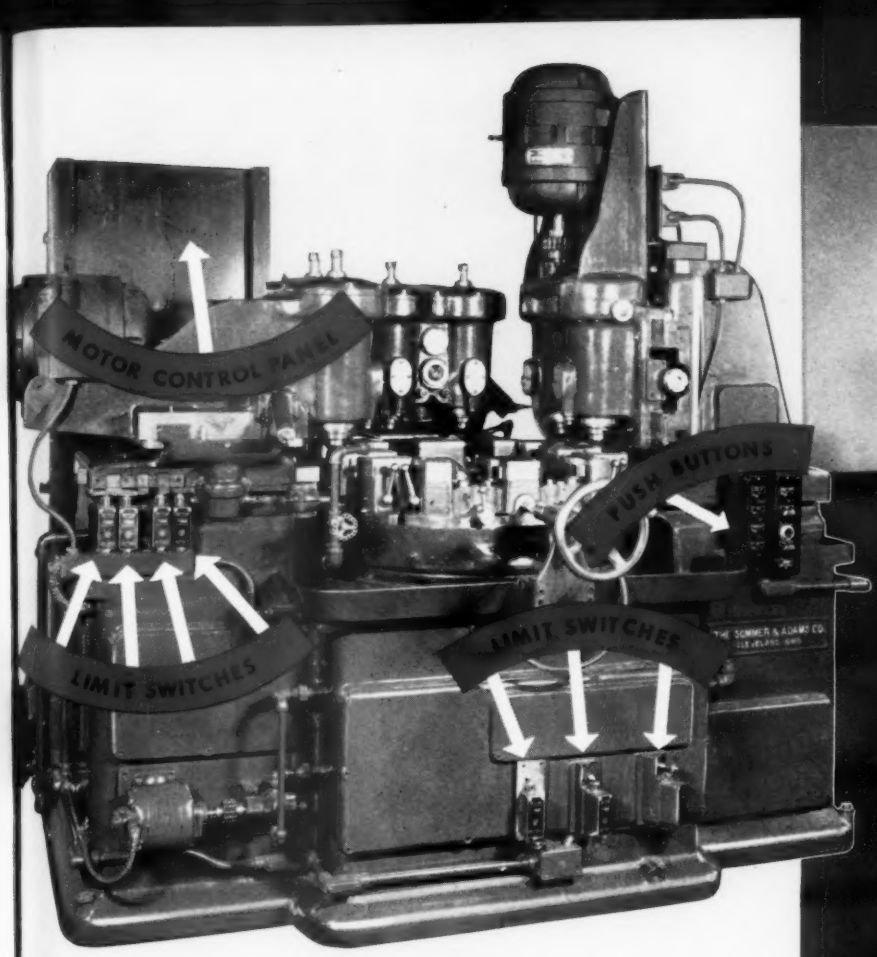


PUSH BUTTON STATIONS
FOR EVERY NEED

Here's an easy way to solve your sequence control problems

LIMIT SWITCHES
FOR SEQUENCE OPERATIONS

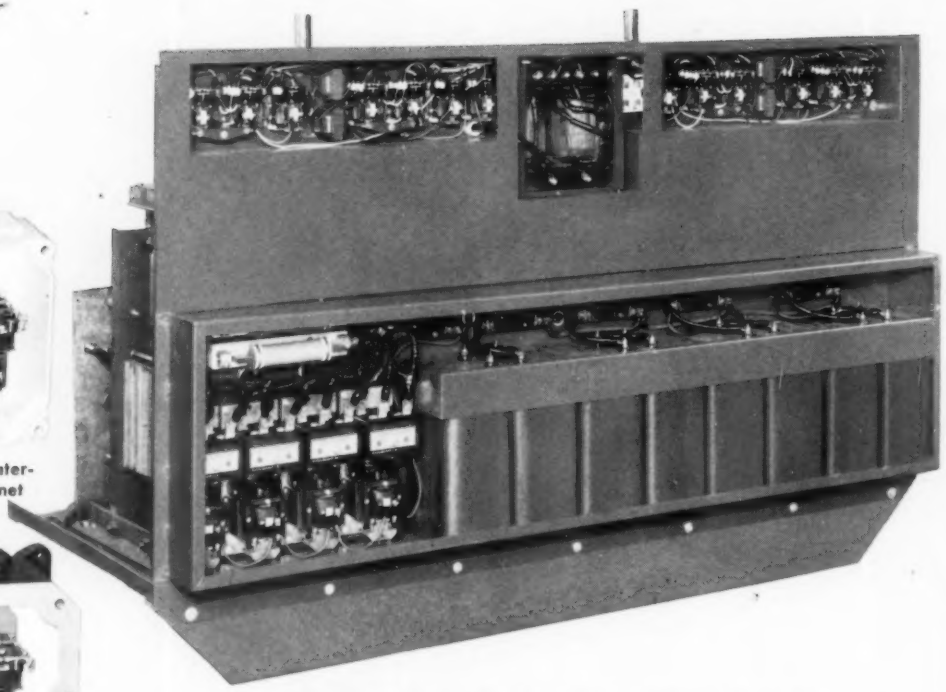
The Sommer & Adams 3-spindle milling machine, illustrated above, shows what an alert machine tool designer can do to solve his *special* sequence control requirements with *standard* Allen-Bradley controls.

A special Allen-Bradley control panel, made of standard contactors and relays, is mounted on the back of the above milling machine. Standard limit switches and master push button stations, all interconnected with the main contactor panel, provide for the desired automatic sequence control. That's all there is to it. No costly development work—no delay.

When you have an Allen-Bradley control catalog in front of you, it is easy to hook up any combination of sequence operations. Our engineers are always available to help you, too. Why not send for Allen-Bradley bulletins on machine tool controls, today.

A-B Quality

ALLEN-BRADLEY
AUTOMATIC MOTOR CONTROLS
QUALITY

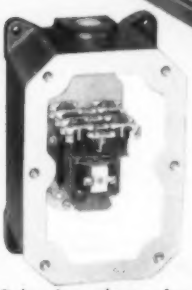


SEVENTEEN A-B RELAYS AND CONTACTORS
on Transformer Type A. C. Welder

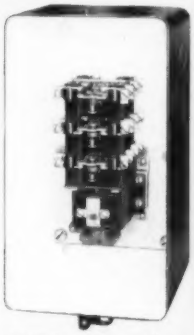
Courtesy Glen Richards Company, Oakland, Cal.

Relay in water-tight cabinet

Relay in general purpose enclosure



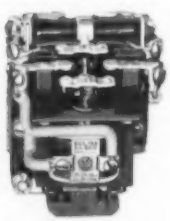
Relay in enclosure for explosive atmospheres



12-Pole relay in general purpose enclosure

RELAYS

800 STANDARD TYPES...TO FIT YOUR SPECIAL NEEDS



Thermostat Relay 2 N. O. Contacts

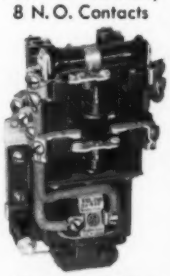
Allen-Bradley relays are designed to electric motor control standards with adequate electrical clearances. They are ruggedly constructed ... and good for millions of trouble-free operations. Only a few of the hundreds of standard Allen-Bradley units are shown on this page. The combinations of contacts, circuits, and enclosures are so extensive that you can easily find a standard relay that will exactly fit your requirements.

Bulletin 700-200 on AC-DC relays is a valuable encyclopedia on relay applications. We will gladly mail a copy on request.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

Machine Tool Relay 8 N. O. Contacts

Machine Tool Relay 4 N. O. Contacts

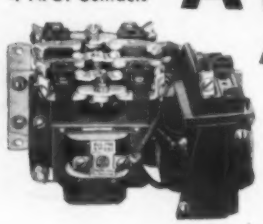


Thermostat Relay 4 N. O. Contacts

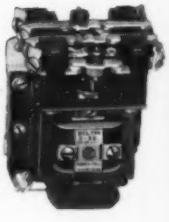
ALLEN-BRADLEY

A-C D-C RELAYS AND CONTACTORS

QUALITY

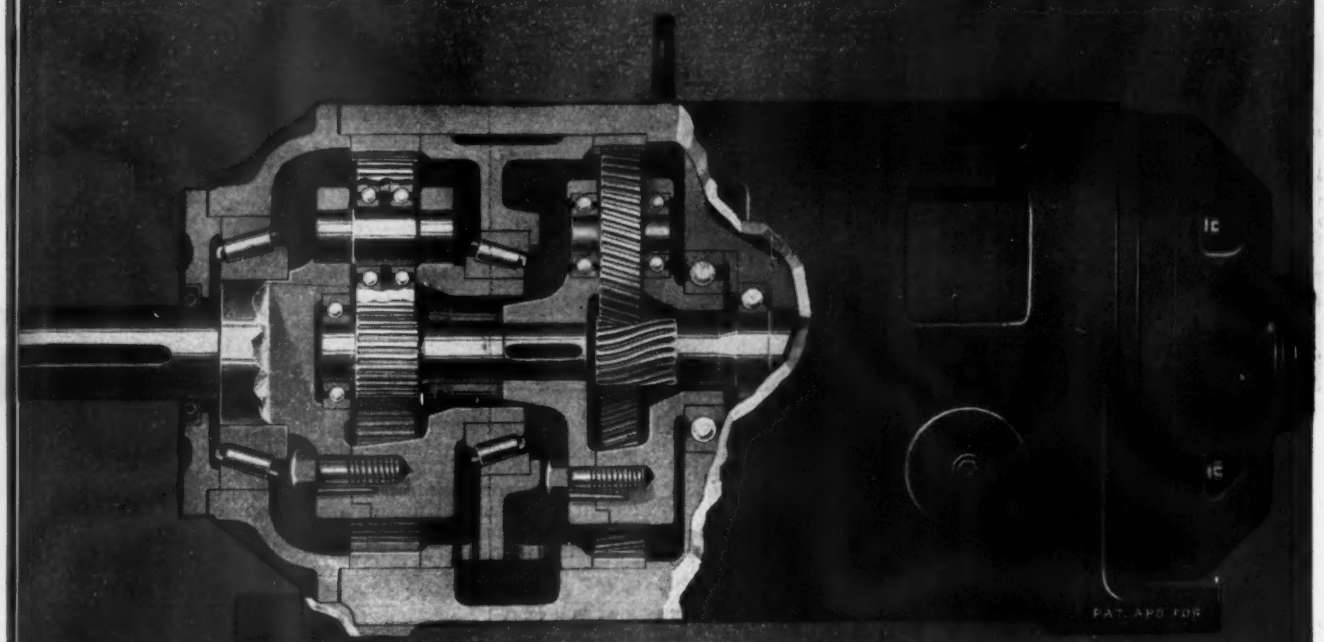


Transformer-Type Relay 2 N.O. and 2 N.C. Contacts

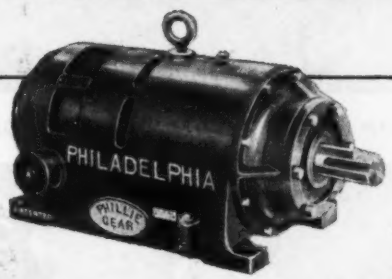


Machine Tool Relay 2 N.O. and 2 N.C. Contacts

NO OVERHUNG PARTS



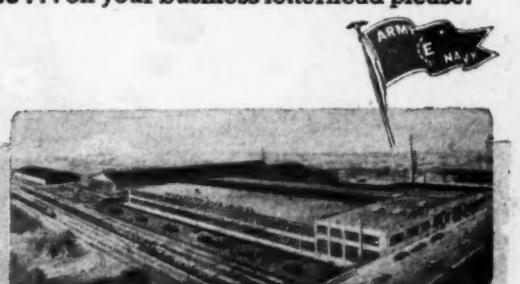
Philadelphia
MOTOREDUCER



...Drive operates without Vibration

Both the horizontal and vertical MotoReduceR combine a motor and planetary speed reducer in a single housing. This results in an attractive streamlined effect that enables the MotoReduceR to blend with, and appear to be an integral part of any machine on which it is installed. More important though is the resulting better alignment of pinions and gears, which reduces noise and wear and conserves space. *Because there are no overhung parts, vibration is eliminated and proper tooth alignment is maintained at all loads.* All parts, however, are readily accessible.

The MotoReduceR will operate efficiently for years, without any attention except periodic changes of lubricant.
A wide range of sizes and ratios are available with standard A.G.M.A. ratings.
For complete information ask for catalog MR. 40 . . . on your business letterhead please.



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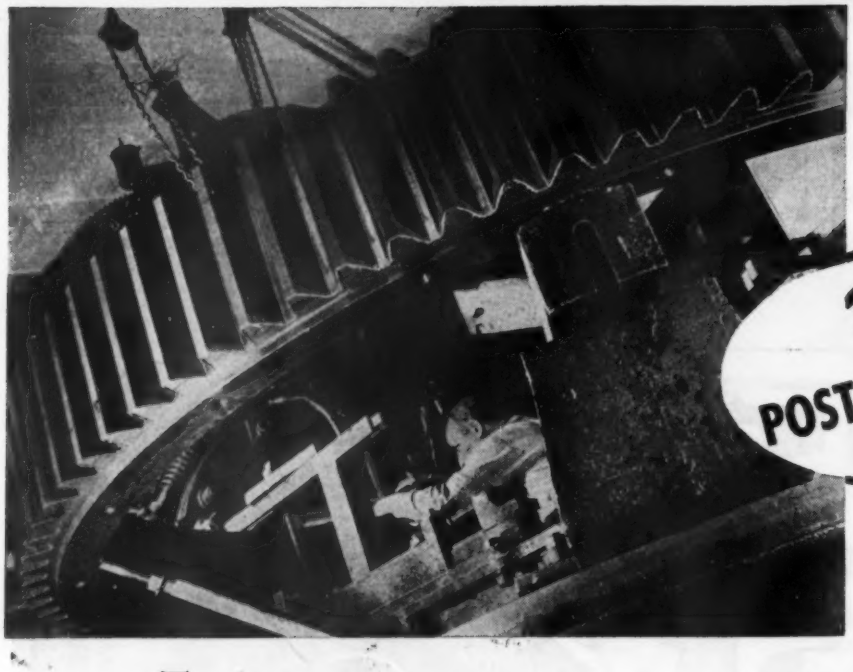

What about **POST-WAR COMPETITION?**

Tomorrow, competition will be more acute, and low costs will again become paramount. Here is one way to help you keep sales expense down. Build sales-making strength and service into the things you make by incorporating Earle Gears in their vital parts. Doing so will give you more saleable products—more satisfied customers. Earle Gears, all types, are made to your specifications, sizes range from inches up to 30 feet in diameter. Write today outlining your requirements. Specify "Earle" when drawing your plans and writing your orders.

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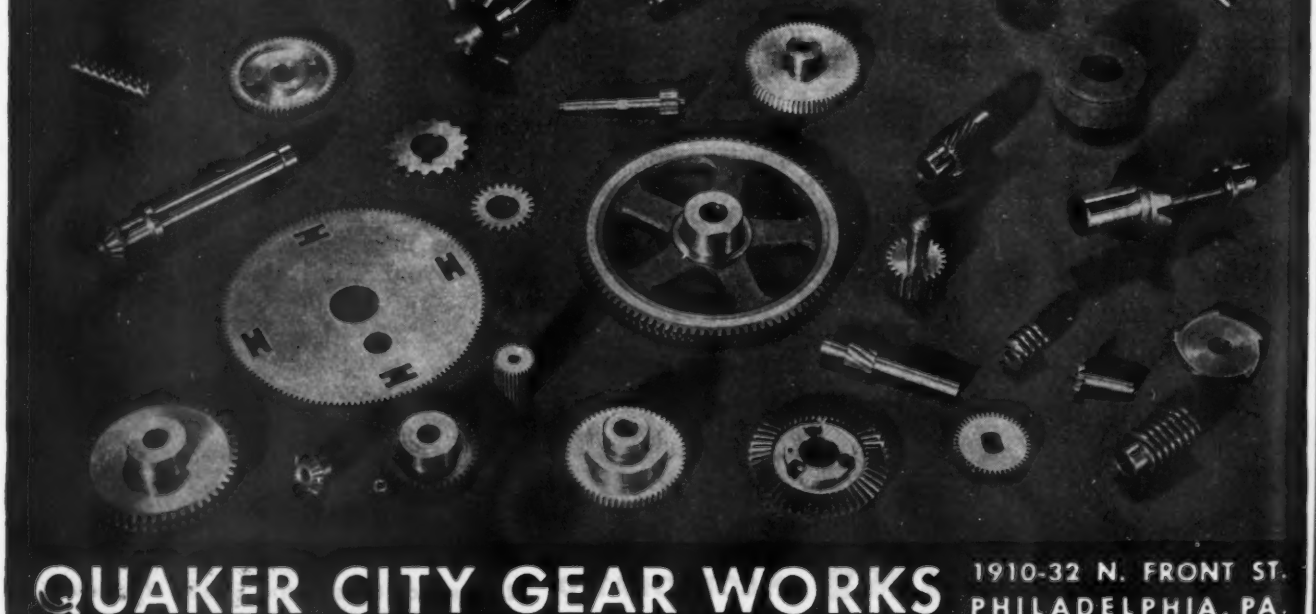
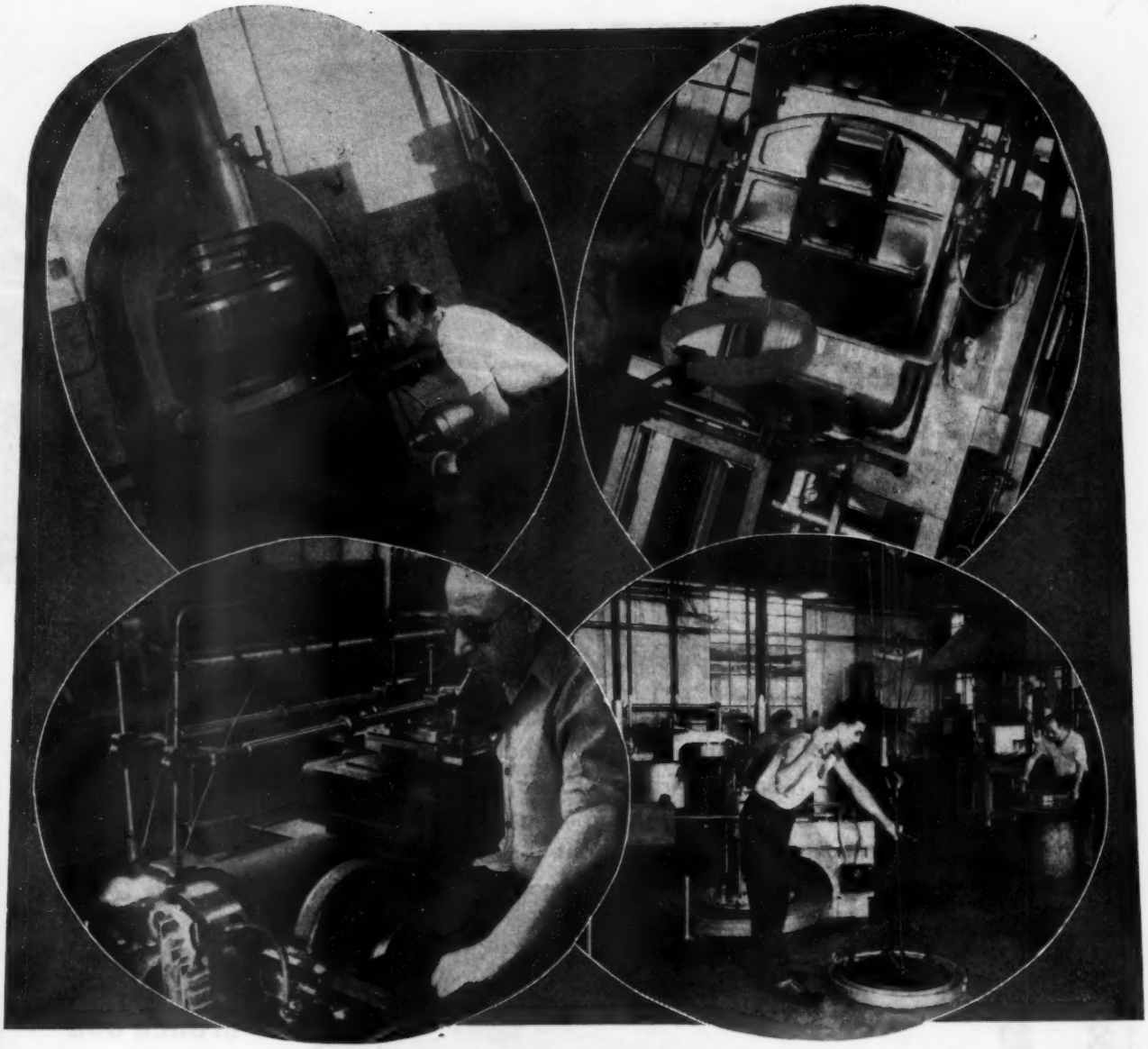
EARLE GEARS

Quaker City Gears Are Rolling with the Armed Forces on All Fronts



QUAKER CITY GEAR WORKS 1910-32 N. FRONT ST. PHILADELPHIA, PA.



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Are Heat Treated Under Laboratory Control

Completeness of Sier-Bath facilities for producing heat-treated gears, together with rigid control and long experience in handling "toughening-up" problems, are assurance that Sier-Bath precision gears will render outstanding performance under the most severe operating conditions.

Sier-Bath is prepared to produce gears from 2" to 52" to any specifications. Ask us to estimate on your requirements. We are prepared to render prompt service.

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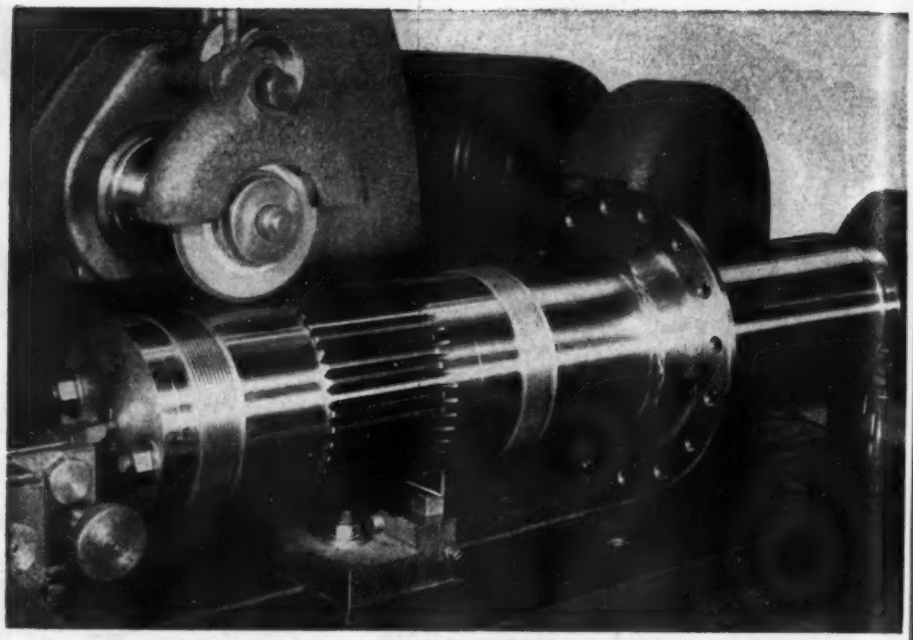
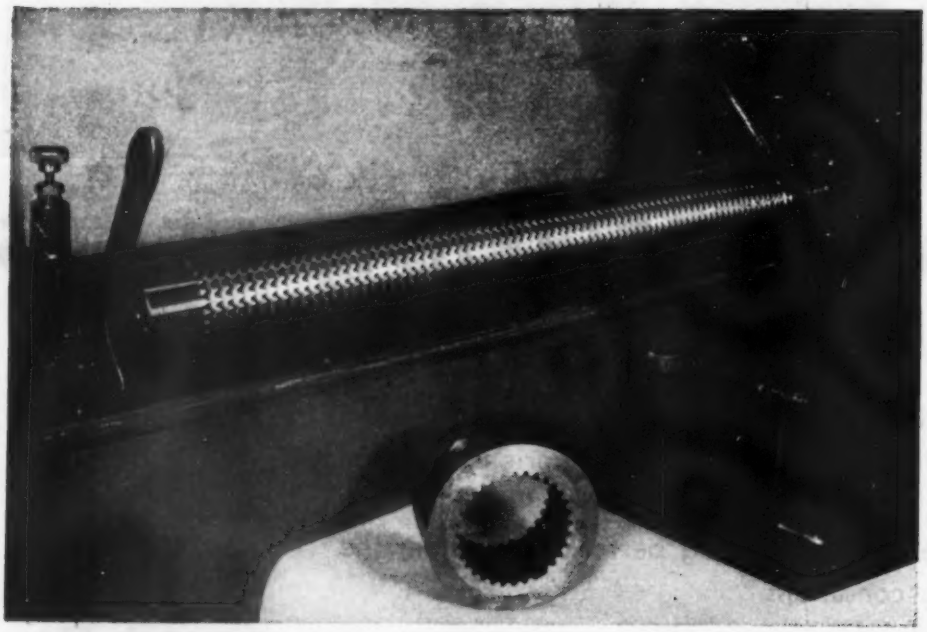
The Doorway to 38 years experience in making Precision Gears

Spline Grinding Aircraft Propeller Shaft



"In the Spotlight"... for Post-War

SPLINE BROACHES UP TO 84 INCHES LONG. Complete Broach Tooling and Engineering Service. . . . . GAGES, Serration or Spline, male or female . . . . Master Gears and Gear Racks. . . . . Master Index Plates. . . . . Splined Arbors for gear-grinding. . . . . Hobbing, Shaving and Checking. . . . . Production Broaching and Machining. *Available from stock: Radius gages for checking form and hook on broach tooth forms.*



Involute Spline Broach and part of Wrench being Broached for Aircraft Engine Crankshaft

GREAT LAKES
Broach & Gage Company

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Better POWER TRANSMISSION for TOMORROW'S MACHINES!

A new era in the transmission of power is promised American industry after the war. Today, on the production lines and in the experimental laboratories of Foote Bros. are new developments that mark a major advance in the economical transmission of power. These developments include:

- *Aircraft gears produced in amazing quantities to power the giant Pratt-Whitney engines.*
- *"A-Q" (aircraft-quality) gears for other applications requiring high speed, light weight or greater efficiency.*
- *Hardened and ground parts for a multitude of uses where precision is important.*
- *Speed reducers of revolutionary design in a range of sizes, ratios and types to meet every need.*
- *Aircraft devices, precision built, embodying the characteristics of light weight and sturdy reliability.*

No matter what your requirements in the needs for power transmission equipment, Foote Bros. can aid you. Why not call on the engineers of one of America's largest and oldest makers of gears, speed reducers and transmission drives to help solve your problems?

FOOTE BROS. GEAR AND MACHINE CORPORATION
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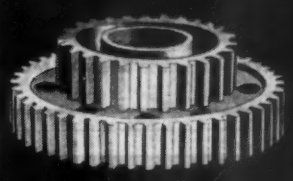
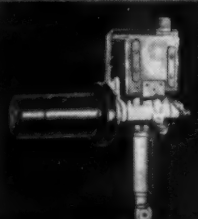
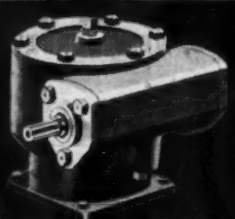


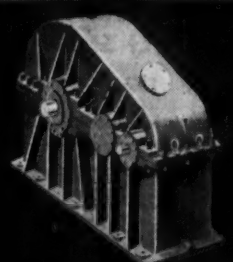
"A-Q" gears produced today for the exacting demands of aircraft engines will assure greater efficiency in machines planned for postwar.



Actuators—small packages of power—that simplify the handling of modern airplanes may have an application to your postwar plans.



Foote Bros. produces compact reduction units to meet special applications. This unit was designed for use with radar equipment.

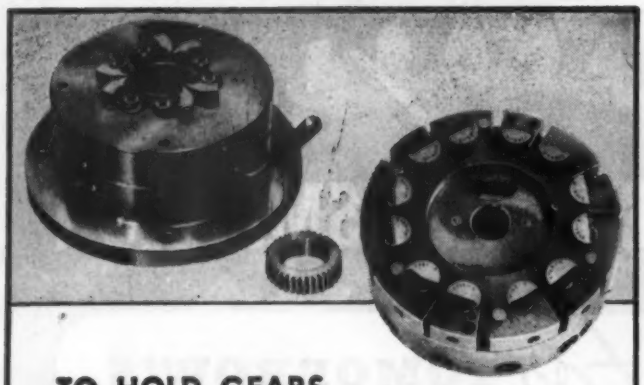


This giant speed reducer 6 feet high is from the complete Foote Bros. line which includes a wide range of sizes and ratios to meet every application.

FOOTE BROS.

Better Power Transmission Through Better Gears

A copy of this informative product engineering manual on "A-Q" gears will be sent to you on request when it is ready.



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Method eliminates distortion. Gears have perfect, round holes. Made for internal and external gears, for spur and helical gears, and for countershaft type gears.

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and the way MEISEL builds gears, there's just one *right* gear for any specific job. Designed for use under conditions that exist, MEISEL Gears actually "belong" to a machine . . . are inherently able to give longer, quieter, more economical service. Investigate the advantages of *specifically* engineered gears by MEISEL.

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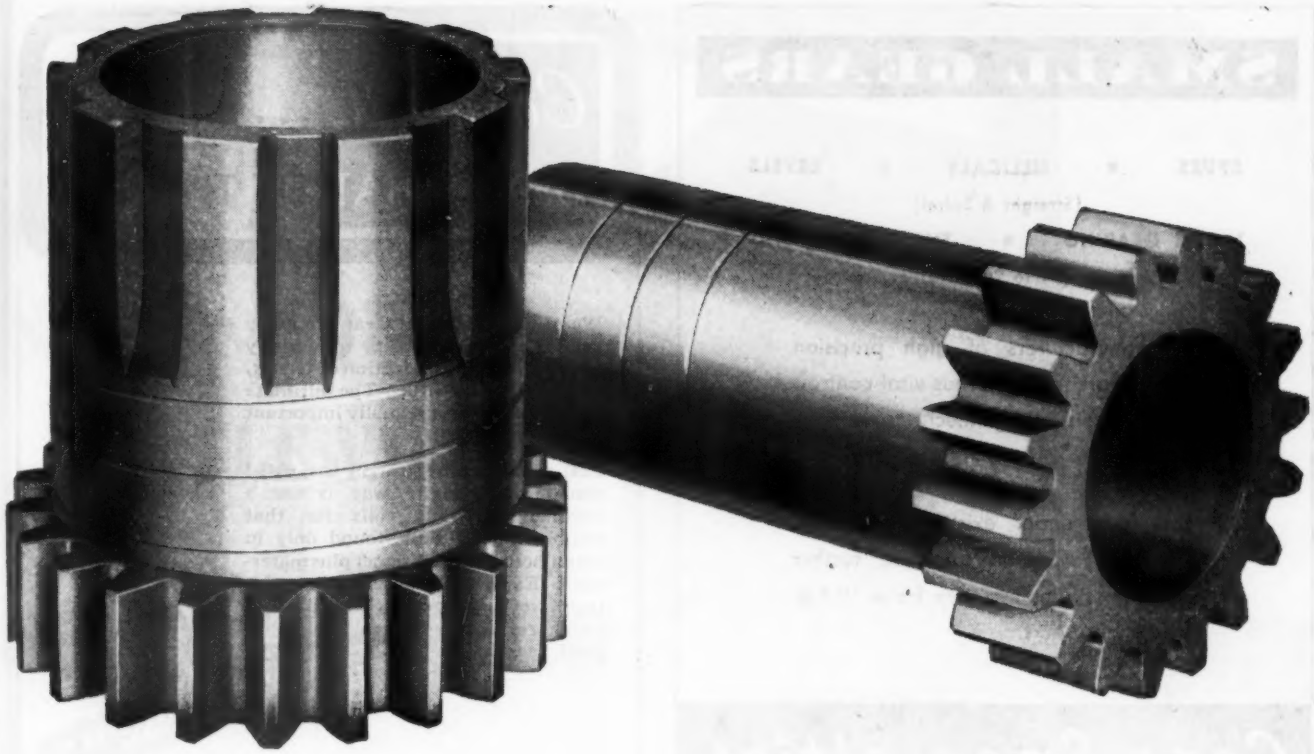

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Helical Gears
Splined Shafts
Worms
Worm Gears
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Miter Gears
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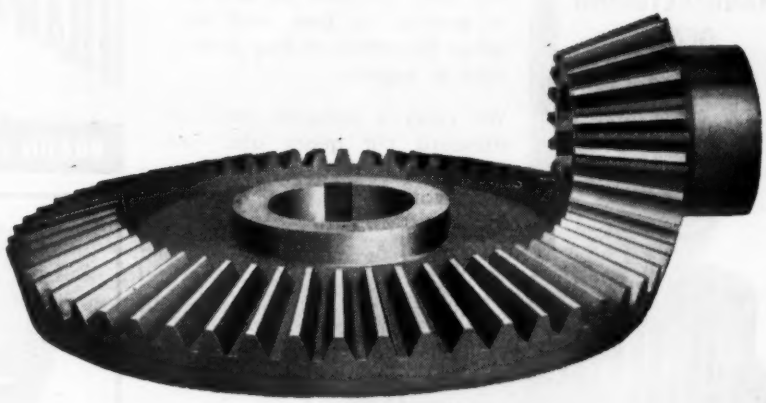
Adams Gears are produced with the finest production and inspection equipment obtainable and they can be furnished to your most exacting requirements.



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★ BEVEL
★ HELICAL
★ SPLINE
★ WORM
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Spur—SPEED REDUCERS—Worm
ALL TYPES OF CUT GEARS
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We carry a complete stock of standard cut gears and can furnish special gears to your specifications.

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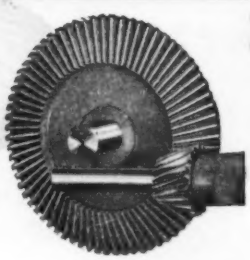

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BILGRAM GEAR & MACHINE WORKS
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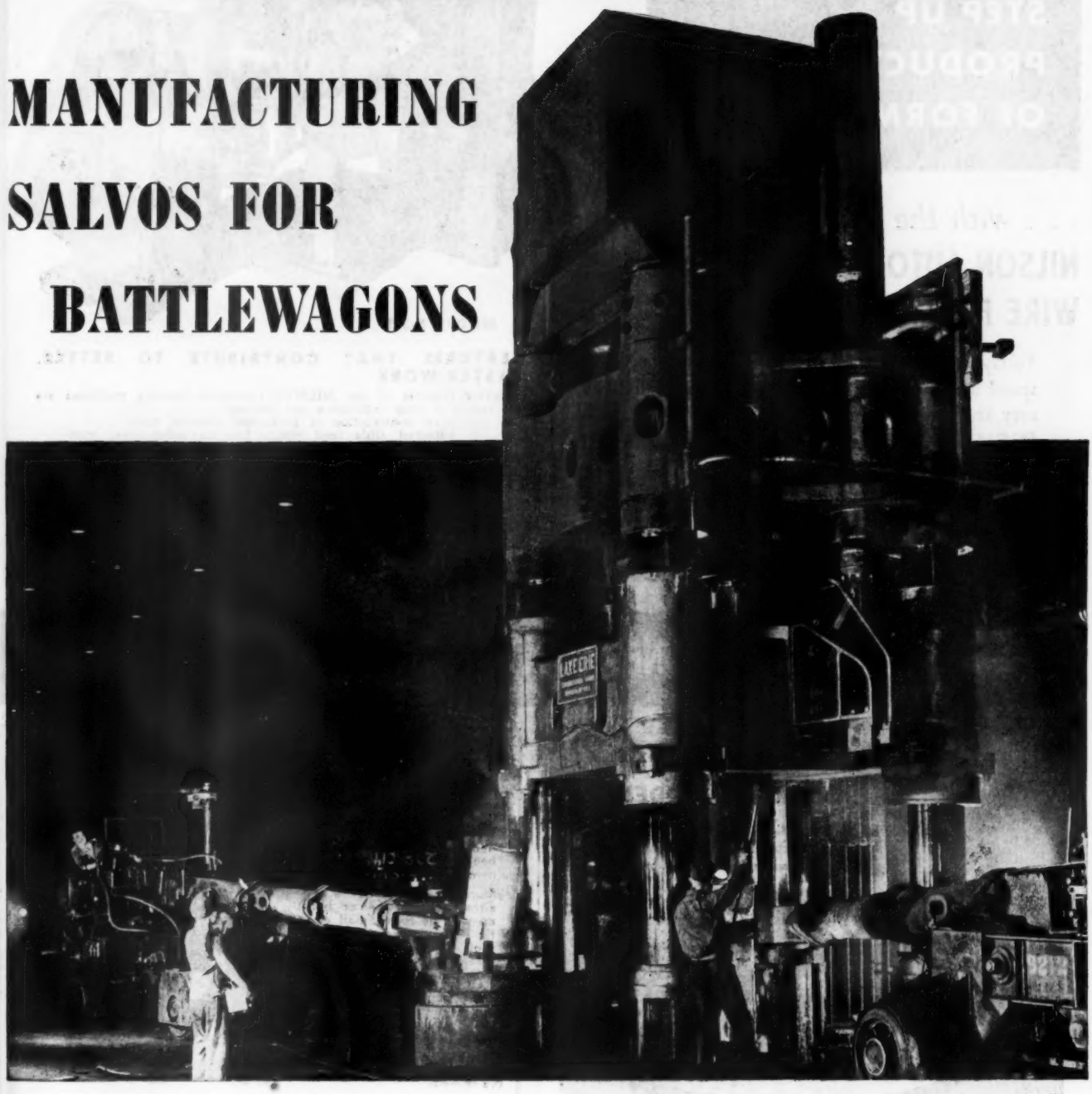
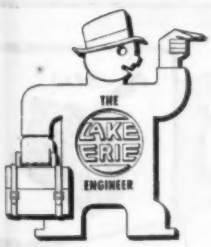
CASE HISTORIES PROVING THE POWER OF THE PRESS

MANUFACTURING SALVOS FOR BATTLEWAGONS





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From it come thousands of the sixteen-inch shells with which our powerful Navy is blowing the Axis out of the seas and pulverizing their land positions.

Designing and building a hydraulic press which produces giant shells in quantity demonstrates the ingenuity and versatility of Lake Erie engineers—versatility which is ready to help you solve reconversion problems by either supplying standard presses adapted to your production methods or building special presses to your specific requirements.

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Write for bulletin 144 giving complete details regarding Lake Erie column type hydraulic presses.

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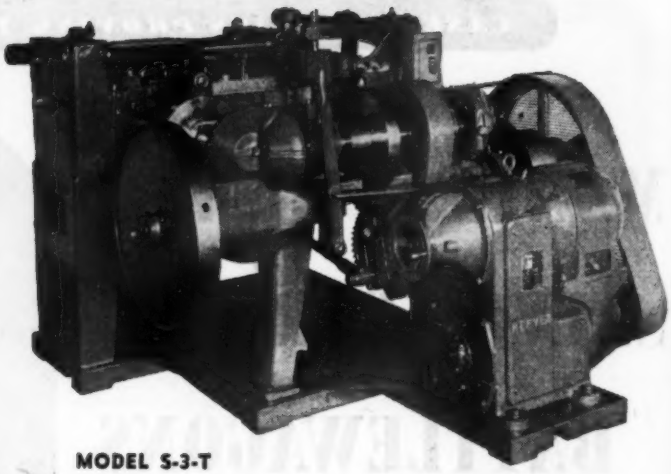
NILSON AUTOMATIC METAL and WIRE FORMING MACHINES

Today's requirements for higher efficiency, greater speed and products of greater uniformity and accuracy are met in the new NILSON RIBBON STOCK FORMING MACHINES. These machines are the achievement of over fifty years accumulated experience in designing and building metal forming machines. Careful selection of materials and skilled workmanship result in machines that are famous for long life and low maintenance.



MODEL S-3-T

FEATURES THAT CONTRIBUTE TO BETTER, FASTER WORK

Superior features of the NILSON four-slide forming machines are the result of long experience and include:

. . . open construction of press and forming tools.
. . . patented slide feed which has an independent cam-operated wire gripping device.
. . . transmission of power operating wire feed through a straight line.

Send for 4-page circular giving further information as well as detailed specifications of sizes and capacities.

• •

We have been engaged in the design and production of special automatic machinery of high production capacity for over thirty years. We are prepared to render a complete service in connection with the design and production of automatic machinery of every description. Consult Nilson on your requirements.

THE A. H. NILSON MACHINE CO... *Bridgeport, Conn., U.S.A.*

GEARS TO ORDER

Spiral and helical gears; special couplings, bushings and collars; pins, pulleys and rollers. Made to your specifications—*promptly.*

KELLEY GEAR & TOOL CO.
Bristol, Tennessee

STRAIGHT SIDE SINGLE CRANK PRESSES
for heavy blanking and forming

Heavier classes of blanking and forming work can be handled efficiently and economically on these presses.

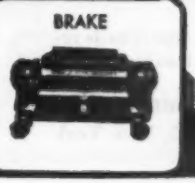
Sturdily constructed with either solid frame or built up with tie rods. Small elastic deflections do not affect tool alignment. All stresses taken centrally. Made also with wedge adjustment for slide for very close work.

Full details on request.

straight side press

ZEH & HAHNEMANN CO.
180 Vanderpool Street
NEWARK N. J.

BENDER



BRAKE

"DIE-LESS" DUPLICATING

NO DIES!

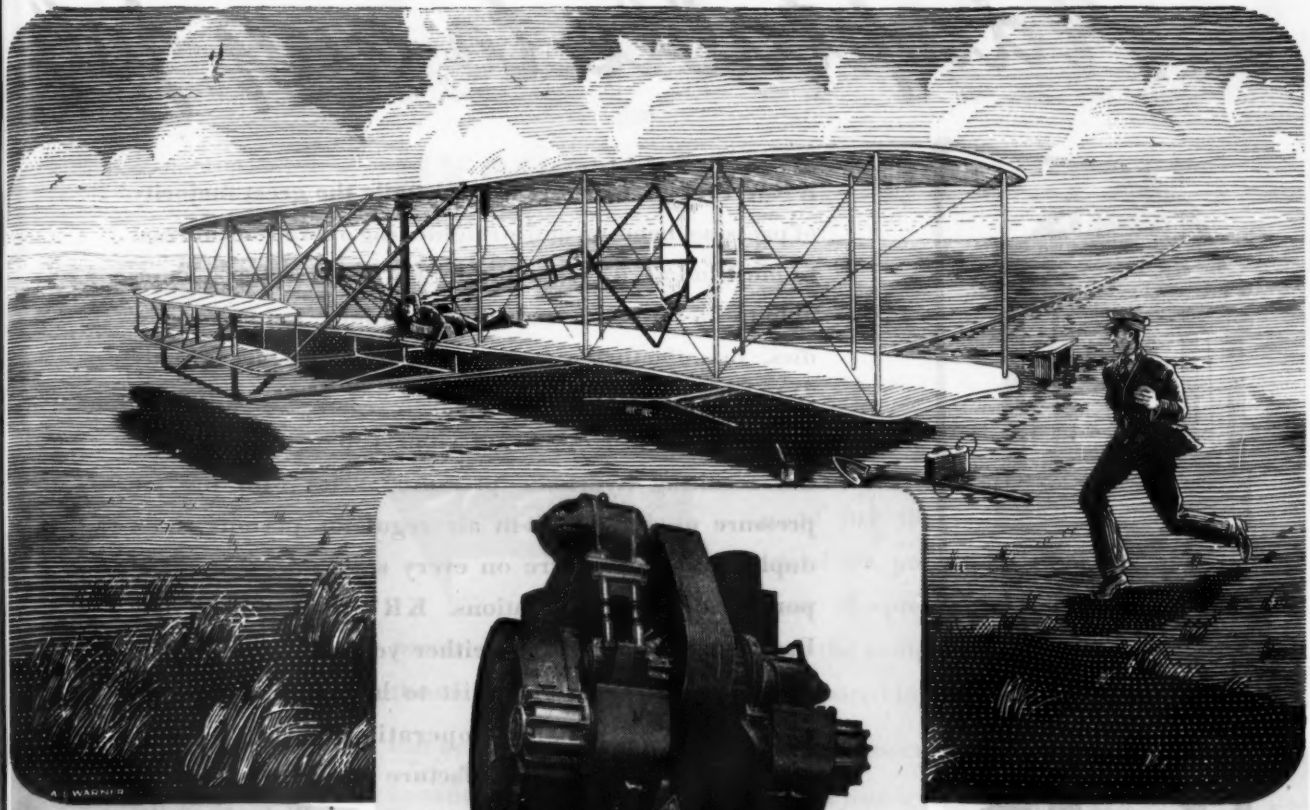
DI-ACRO PRECISION MACHINES "DIE-LESS" DUPLICATING

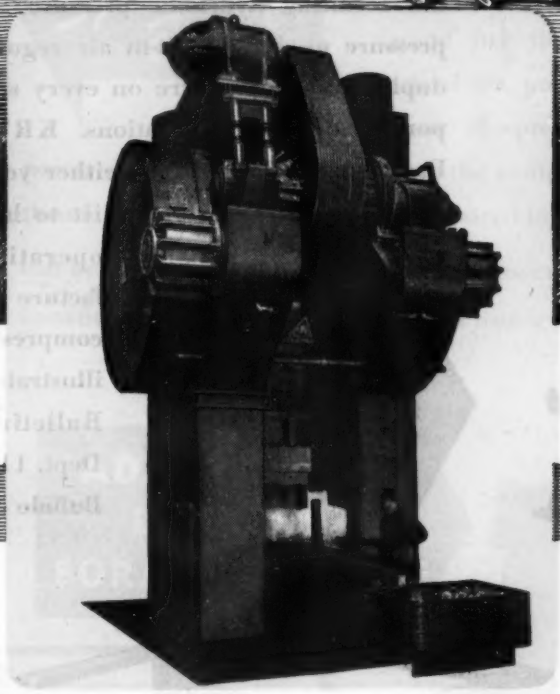
"DIE-LESS" DUPLICATING might be described as a new industrial technique made possible by the accuracy, extreme adaptability and ease of operation of DI-ACRO Precision Machines — Shears, Brakes, Benders — especially when used as a continuous, integrated production process.

The DI-ACRO System of METAL DUPLICATING WITHOUT DIES has proven its adaptability in making parts just as accurately as can be done with dies, to a tolerance of .001″ in all duplicated work. The delay of waiting for dies is avoided, deliveries speeded up. *Write for Catalog.*

SHEAR

O'NEIL-IRWIN MFG. CO. 311 EIGHTH AVE. SO., MINNEAPOLIS 15, MINN.





THEY DIDN'T INVENT IT!

History records many heavier-than-air flying machines. But stability in the air, to make powered flight practical, is something else again. That's where the Wright brothers succeeded in analyzing a baffling problem and solving it with the ailerons that distinguished their machine.

Presses for forming metal have a relatively long history too. It took the first Clearing press, though, to point the way to new concepts of what presses could do and how they should be built. Practical results of those ideas are faster work cycles, greater ease and economy of operation and maintenance of closer tolerances than were formerly considered practical in stamping.

Today it will pay you to tell Clearing what you would like a press to do for you. Investigate the cost-reducing possibilities of Clearing presses now. See how their adaptability to a wide range of products, materials and installation requirements has been able to solve so many "can't be done" press problems. Your inquiry entails no obligation, so write today. Clearing Machine Corporation, 6499 West 65th Street, Chicago 38, Illinois.

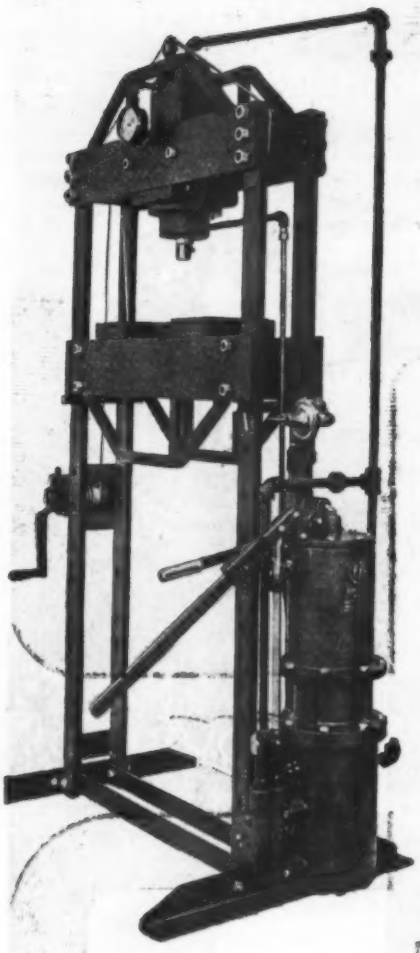
CMC CLEARING

MECHANICAL AND HYDRAULIC PRESSES

FOR SUCH OPERATIONS AS DRAWING + BLANKING + FORMING + FORGING

CLEARING ★

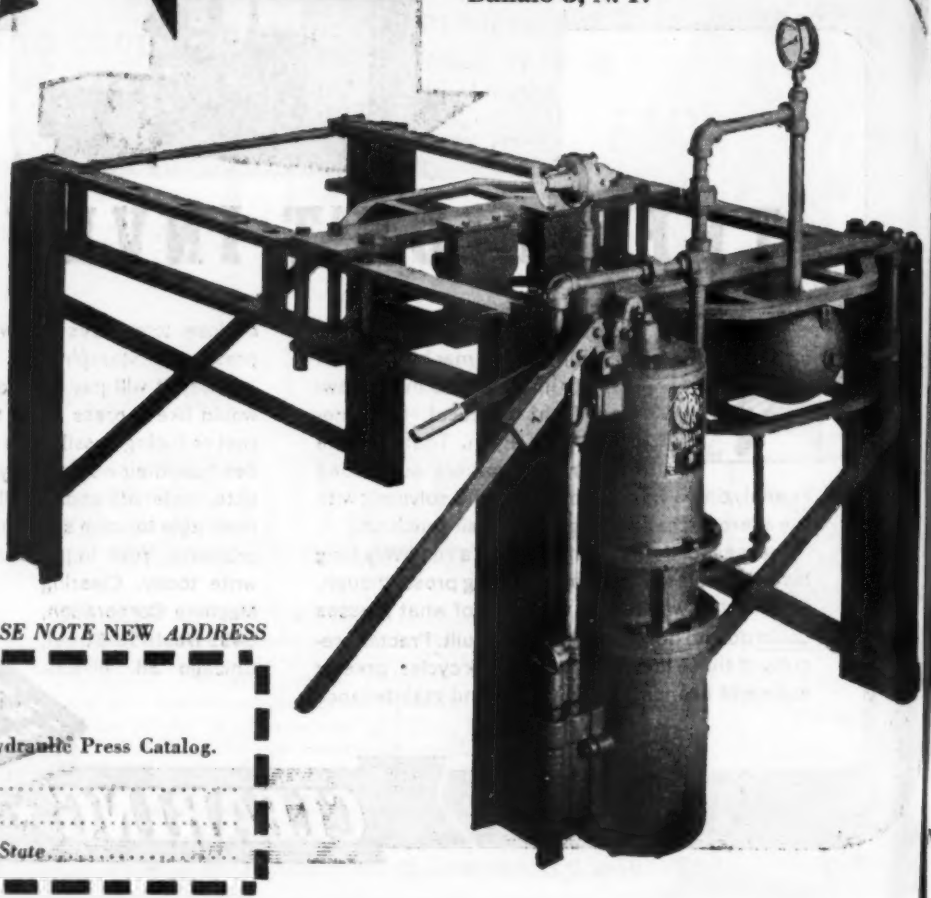
Adaptable to any job, a



KRW Presses are designed to handle the great majority of pressing, bending and straightening operations normal to most industries. In addition, KRW Presses are adaptable to literally hundreds of special jobs. Using low-cost dies, manufacturing costs on many items are greatly reduced.

Using air pressure varying from 100 to 225 pounds, the resulting hydraulic pressure varies with the air pressure used. A built-in air regulator permits exact duplication of pressure on every stroke . . . this is important on many operations. KRW Hydraulic Arbor Presses are available for either vertical or horizontal operation or specially built to handle a particular operation. We also manufacture suitable capacity air compressors. Write for fully-illustrated Hydraulic Arbor Bulletin. K. R. WILSON, Dept. 11, 215 Main Street, Buffalo 3, N. Y.

VERTICAL OPERATION



HORIZONTAL OPERATION

PLEASE NOTE NEW ADDRESS

K. R. WILSON
215-217 Main St., Buffalo 3, N. Y.
Please mail me a copy of your Hydraulic Press Catalog.

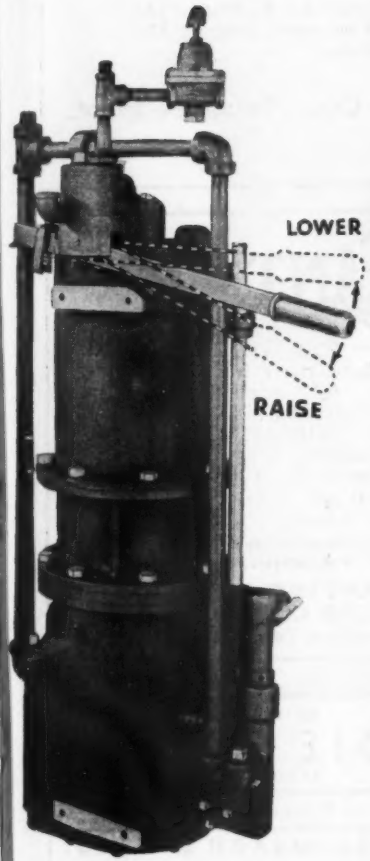
Name .....

Address .....

City ..... *State* .....

these Low-Cost KRW

HYDRAULIC ARBOR PRESSES SAVE TIME, SPACE AND MONEY



THE KRW *Speedi-Booster*

THE REASON WHY KRW PRESSES ARE FAST AND ACCURATE. The KRW Speedi-Booster eliminates the need for the conventional Capstan wheel or pumping lever. Instead, it uses compressed air as the motive power operating the ram. Because the compressed air is controllable through a pressure regulator, any desired tonnage pressure at the ram can be obtained and duplicated. Ram movement (up, down or stop) is instantly controlled with the slightest fingertip movement of the lever.

ADAPTED AS A LOW-COST FORMING BRAKE

AVAILABLE TONNAGE PRESSURES
25-50-60 TON PRESSES

AIR PRESSURE	7" AIR CYLINDER		9" AIR CYLINDER	
	2" Oil Cylinder	1¾" Oil Cylinder	2" Oil Cylinder	1¾" Oil Cylinder
100 TO 200 POUNDS	10 to 22 Tons	14 to 29 Tons	17 to 35 Tons	23 to 47 Tons

75 TON PRESS

AIR PRESSURE	9" AIR CYLINDER	
	2" Oil Cylinder	1¾" Oil Cylinder
100 TO 200 POUNDS	25 to 51 Tons	33 to 68 Tons

Write Today for the KRW HYDRAULIC PRESS CATALOG

K. R. WILSON
BUFFALO 3, NEW YORK

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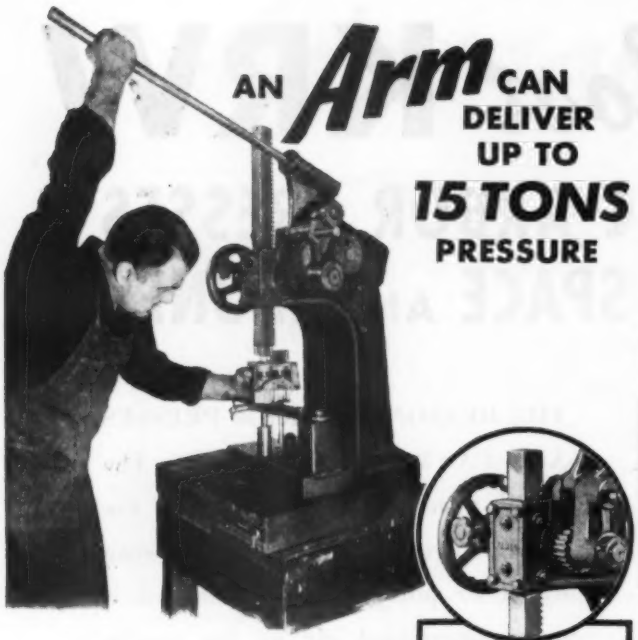
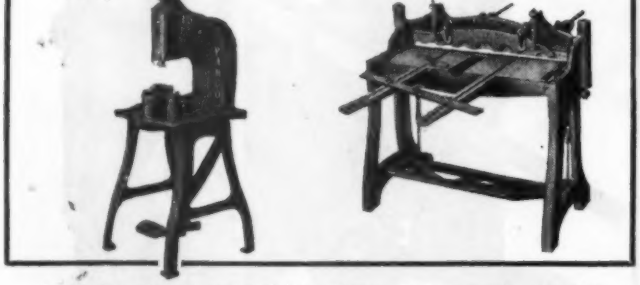


AN *Arm* CAN DELIVER UP TO *15 TONS* PRESSURE

Only Famco Presses have front and side gib adjustment. Keeps ram in perfect alignment, compensates for wear, eliminates "shimmy."

Famco Arbor Presses are saving time and costs on thousands of assembly and dismantling jobs. Girls can operate Famco Arbor Presses through full shifts without undue fatigue. Famco Arbor Presses are fast and ruggedly constructed for dependability . . . require no electric power. Investment is low. Upkeep is negligible. Small floor space required. Available in 32 models (for bench and floor mounting), in plain lever, simple ratchet, or combination compound and simple ratchet types. See Famco Arbor Presses at your dealers or write today for catalog and price list.

FAMCO MACHINES NEED NO POWER

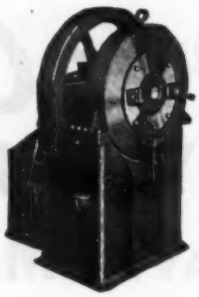


Famco Foot Presses, operated by girls or women, are widely used to step up hundreds of light stamping and forming jobs. Sturdily built in 10 models (bench and floor stand mounting), they require no electric power, need small floor space. First cost and upkeep are low. "Set up" is simple . . . operation is easy.

Famco Foot Powered Squaring Shears, in five sizes (cutting widths from 22" to 52"), shear up to 18 gauge mild steel. Have reinforcing tie rod for knife alignment . . . encased compression springs . . . knives with tool steel cutting edges. Three largest models have "hold down" attachment.

FAMCO MACHINE CO., 1316 18th St., RACINE, WIS.

famco ARBOR PRESSES FOOT PRESSES SQUARING SHEARS



THE TORRINGTON ROTARY SWAGING MACHINE

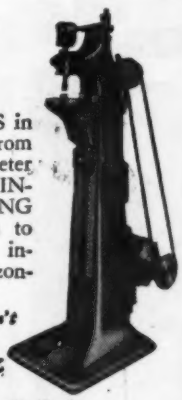
— with 4000 forceful squeezing hammer blows per minute—makes metal tougher and more elastic. Send for booklet—"The Torrington Swaging Machine."

The Torrington Co., Swager Dept.
56 Field Street Torrington, Conn.

GRANT

RIVETERS — PIONEERS in their line—head rivets from smallest to 5/8" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.

Write for literature and don't forget to send samples.



THE GRANT MFG. & MACHINE CO.
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BAUMBACH STANDARDIZED DIE SETS

BETTER-MADE
DIE SETS
AT LOWER COST
46 Styles—195,000 Sizes
E. A. BAUMBACH MFG. CO.
Machined Steel Semi-Steel
Send for our new catalog
1812 South Kilbourn Ave., Chicago, Ill.

PRESSES
FEEDS
AUTOMATIC EQUIPMENT
The V & O Press Company, Incorporated
HUDSON, NEW YORK

DANLY PRECISION DOWEL PINS
STANDARD AND .001 OVERSIZE

Hardened and Precision ground to a tolerance of ± .0001 of an inch. Available in .001 oversize for repair or renewal work.

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We can't just pick 'em out of a hat!

but we can provide the simplest way of making washers ...

HOVIS UNIVERSAL MASTER WASHER DIES

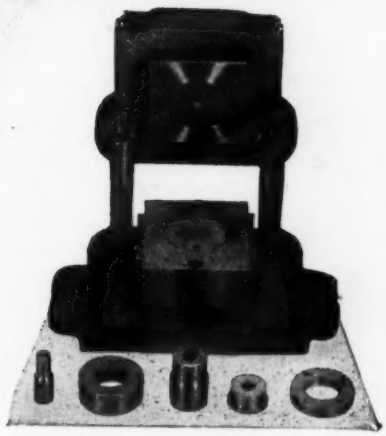
No, there's no magic about the Hovis method, but it is so far ahead of the old way of making washers, there is no comparison! Instead of making a new die for each size and type of washer, you simply invest in Hovis Master Dies to fit your requirements and then use 5 EASILY REMOVABLE, INTERCHANGEABLE PARTS to make any size washer.

And remember, the Master Dies themselves do not become obsolete. So . . .

When You Buy For War Production, You Invest in Peacetime Equipment

A new set of interchangeable parts are all you will need for your new postwar products.

Ask today for illustrated, descriptive literature.



Made in 5 sizes:
¾"—1½"—2½"—4"—6".

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SCREWLOCK CO.
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Van Dyke Michigan
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HOVIS SCREWLOCK COMPANY
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Please send me your new illustrated folder showing "The HOVIS WAY" of making washers.

My name is .....

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Address .....

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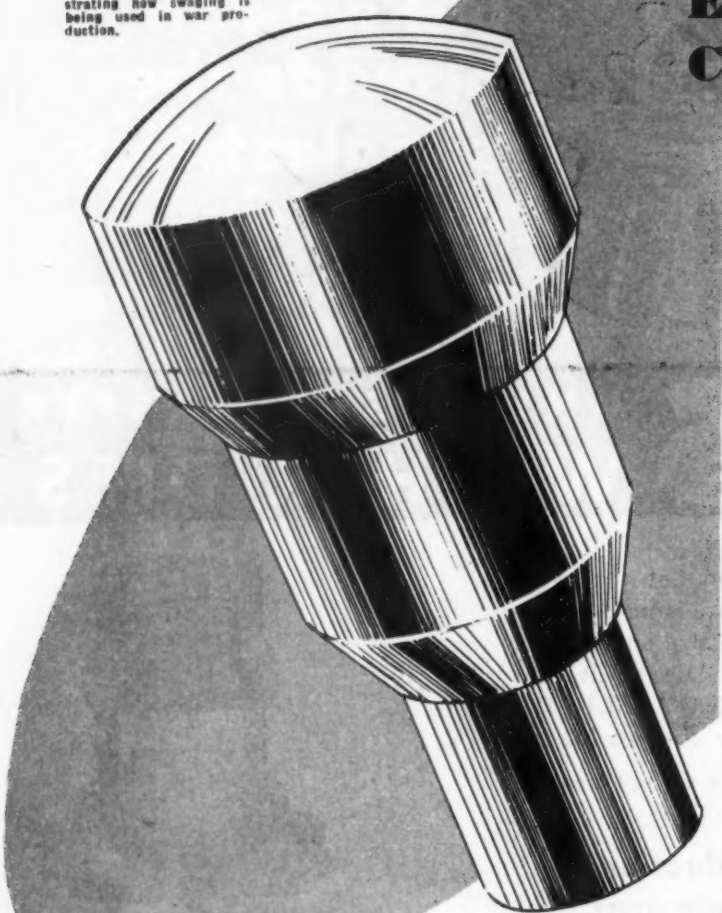
Can you produce this part...

WITHOUT MACHINING?

First of a series demonstrating how swaging is being used in war production.



ETNA SWAGING UNITS Can... and do!

Complicated tapering, sizing and reducing jobs can be handled easily, quickly and with extreme accuracy on ETNA Swaging Machines — WITHOUT RESORTING TO MACHINING OPERATIONS. Swaging will cut production time and costs in your plant . . . first by reducing (and frequently eliminating) preliminary machining operations and, second, by savings in material—for with Swaging no metal is cut away. Rather it is compressed, thus strengthening the part structure!

A note to ETNA today, describing your tapering, sizing and reducing problems will bring a complete description of the advantages of Swaging to your operations.

ETNA Swaging Machines are built in diameter capacities from 3/8" to 8" die lengths and from 1" to 18", to handle tapering, sizing and reducing of hollow, solid, round or angular parts. Larger units are built to your specifications.

IF IT'S A QUESTION OF TAPERING, SIZING OR REDUCING OF ROUND SOLIDS OR TUBING

"Ask ETNA about Swaging"

The ETNA Machine Co.

3400 MAPLEWOOD AVENUE

TOLEDO 10, OHIO

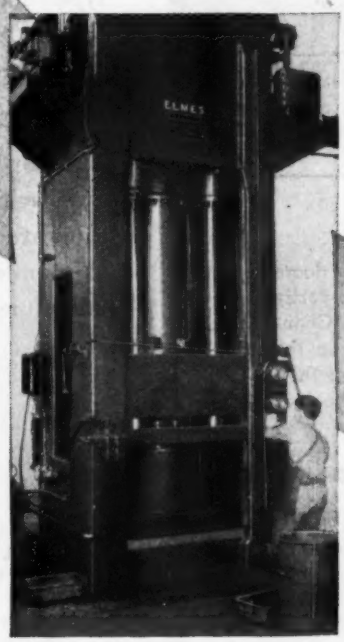
A MILLION POUNDS ON THE MAKE!

AT A ST. PAUL WAR PLANT

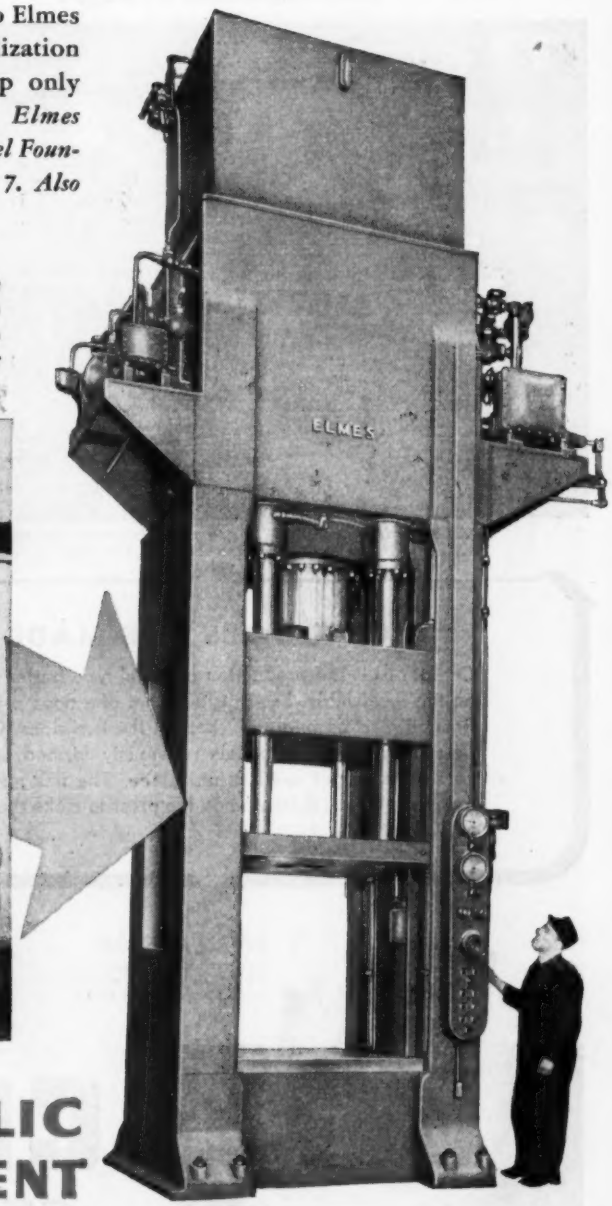
HERE is *Power to Produce!* This 500-ton drawing and forming press is but one of several high-speed Elmes presses working on war materials at a well-known war plant in St. Paul—and more are now on order, all with Elmes simplified controls for fast work; few rejects; long die runs; and low-cost, on-time production. No equipment could have a better testimonial than such endorsement from this famous organization.

Put your pressing problems up to Elmes for the knowledge only specialization can teach; for the craftsmanship only long experience can produce. *Elmes Engineering Works of American Steel Foundries, 1001-1013 Fulton St., Chicago 7. Also manufactured in Canada.*

With main ram at top of 53" adjustable stroke, and blank holder up, work is set in die. Interlocking mechanism prevents ram operation until holder is seated.



Forming is done at pressures up to 500 tons. Blank holder exerts up to 100 tons with independent variation to suit drawing needs. Ejector cylinder in press bed. Semi-automatic operation.



ELMES HYDRAULIC EQUIPMENT

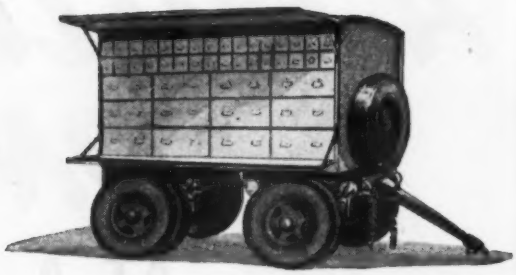
METAL-WORKING PRESSES · PLASTIC-MOLDING PRESSES · EXTRUSION PRESSES · PUMPS · ACCUMULATORS · VALVES · ACCESSORIES

Flanging outside sheet for trailer door. Steel used is 18 gauge. Size of completed door is 2' 0" x 10' 0".

Final flattening of outside flange after channels and reinforcing panels are spot-welded in position.

HOW DOORS ARE MADE

Of interest is the production of panel-type trailer doors on the Steelwelds. The outside sheet of a door is partly flanged, first on one end, then on the two sides. Channels and reinforcing panels previously formed on the presses, are spot welded into place. The flanges then are given a final flattening on the press to make the door a solid, rigid unit.



FIELD TRAILER PRODUCTION *SPEEDED with* STEELWELDS

Since Pearl Harbor, the same Cleveland Steelweld Presses that previously had been busy producing such peace-time items as truck bodies and cabs at the Baker-Raulang Company, Cleveland, have been in continuous production on Field Stockroom Trailer parts including panel-type doors and 125 drawers for each trailer. This work involves various braking operations. Bends must be straight, sharp and accurate.

Baker-Raulang declares that Cleveland Steelwelds meet all the requirements for their exacting work. They are safe and easy to operate. Dies are quickly changed. Only minimum maintenance is required.

★

GET THIS BOOK!
CATALOG No. 2002 gives complete construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.
1127 EAST 283RD ST. WICKLIFFE, OHIO.

CLEVELAND
STEELWELD PRESSES
BENDING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

BUILDING THE RUGGED MACK PRIME MOVER CALLS FOR RUGGED MACHINES!

BAKER Model 30-HH ANSWERED THE CHALLENGE!

Here, BAKER Model 30-HH (a horizontal, opposed type, hydraulic feed machine) speeds manufacture of rear axle housings for Mack Prime Mover trucks, widely used by the armed forces. Operations quickly and efficiently handled on this machine include rough, second and finished boring axle-tube bores. Each opposed single spindle head has a 52" travel . . . allows tools returning clear of fixture for fast, easy change of tooling. The direct vee-belt motor drive head affords three quick speed changes, made with convenient lever controls. Cycling is easy and positive due to the innovation of a BAKER-designed quick change cycle attachment. Flexible design has been maintained, as in all BAKER units, and the Model 30-HH may be arranged to handle a variety of operations.

This example of BAKER's ability to supply machines for faster and more efficient production is but one of many that could be cited. Refer *your* drilling, tapping and boring problems to the BAKER Engineering Department. If we don't have the machine your operations require, we'll design it!

BAKER BROS., INC.
TOLEDO...OHIO

SINGLE AND MULTIPLE SPINDLE UNITS FOR DRILLING, BORING & TAPPING

Logan
a name to remember when you think of BETTER LATHES
the only lathe which combines all these SIX FEATURES
1. Ball Bearing Headstock for sustained spindle accuracy, high speeds.
2. Self Lubricating Bronze Bearings at vital points.
3. Bed design, two V-ways and two flat ways, precision ground, assures alignment of major parts.
4. Back Gears enclosed in headstock and back gear shifter rack at operator's finger tips.
5. Rubber cushioned countershaft and 3-point suspension assures smoothness.
6. All belts and gears enclosed. Raising of cone pulley guard automatically releases belt tension.
BRIEF SPECIFICATIONS Common to all LOGAN LATHES
Swing over bed, 10½"
Bed width across ways, 6 13/16"
Bed length, 43⅛"
Size of hole thru spindle, 23/32"
Spindle nose diam. and threads per in., 1½"—8
12 spindle spds., 30 to 1450 r.p.m.
Size of motor, ½ or ⅓ h.p., 1750 r.p.m.
These six features add up to precision performance, high speed production, long lathe life and more safety for the operator. They explain why the name Logan stands for BETTER Lathes in every field of industry. See your Logan dealer or write for catalog of Logan Lathes.

B-4

LOGAN ENGINEERING CO. · CHICAGO 30, ILLINOIS

TIME SAVER for BUSY WAR PLANTS

To keep vital war work on the move . . . and at the same time prepare for civilian production . . . invest now in a Linley . . . the compact, speedy Milling & Jig Boring machine so valuable in busy toolrooms. It is now doing precision work on dies, jigs, models, metal patterns and related operations . . . with quick set-up, fast changeover and at low cost.

Features are: 8 spindle speeds to 4250 r.p.m., velvet feed without quill backlash, direct micrometer setting, grease-sealed bearings. Table top to spindle end 11½", table size 7"x17½", floor space 18½"x20" . . . a compact, money-making unit that keeps jobs moving in the toolroom.

FULL DETAILS IN BULLETIN . . . ON REQUEST

LINLEY BROTHERS COMPANY
664 STATE ST. EXTENSION
BRIDGEPORT 1, CONN.

ABRASIVE

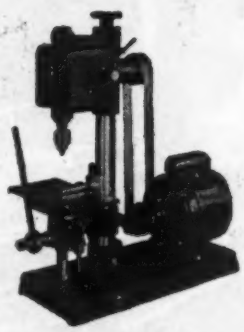
ACCURACY BOOSTS PRODUCTION

No. IG	INTERNAL GRINDER	**No. 34**	VERTICAL SPINDLE SURFACE GRINDER
No. 1½	HAND FEED SURFACE GRINDER	**No. 3B**	AUTOMATIC FEED SURFACE GRINDER

Look for Our Full Page Advertisements

ABRASIVE MACHINE TOOL CO.
EAST PROVIDENCE 14, RHODE ISLAND

HAMILTON-MUEHLMATT

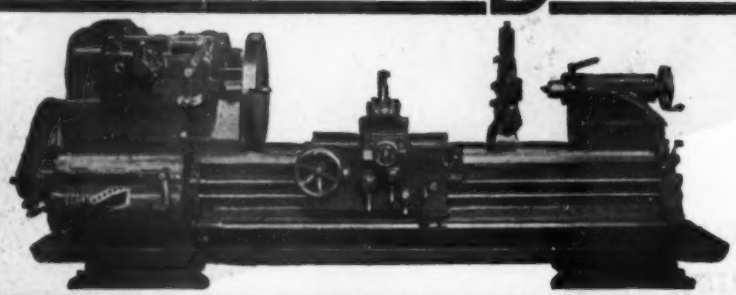


. . . for Speeds Sensitive Tapping

A high production sturdy little machine particularly suited to precision tapping of light work such as instruments, cameras, watches, clocks and business machines. Sensitivity of operation, and high spindle speeds account for accurate work without breakage of fine taps. Can be attached to any light socket. Write for complete information.

The Hamilton Tool Co.
HAMILTON OHIO

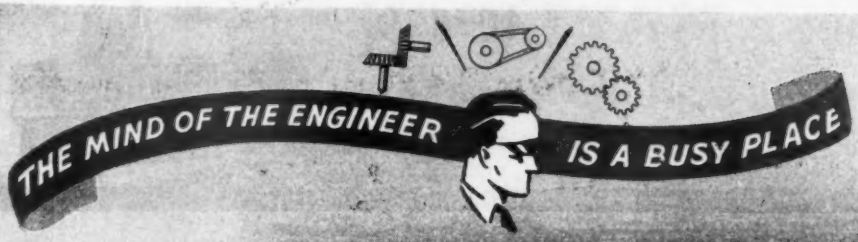
SPRINGFIELD GEARED HEAD LATHES

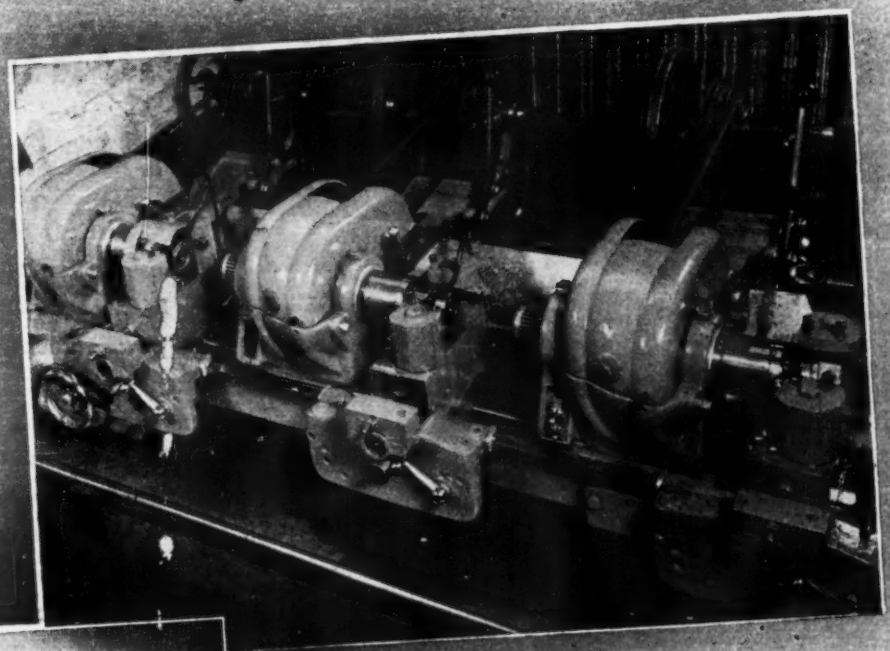


for peacetime or war production!

A lathe purchased now, for round-the-clock war production, must still meet peacetime requirements. Therefore, specify SPRINGFIELD lathes —flexible, efficient, ideal for emergency or normal production. SPRINGFIELD lathes are built in sizes from 14" to 30". Write for descriptive bulletins, prices, deliveries, etc.

The SPRINGFIELD MACHINE TOOL COMPANY • • • SPRINGFIELD, OHIO, U.S.A.





This special "gang" lathe, for producing the secret aviation part shown, was created by Mr. Robert Crane and Mr. E. O. Wall, Detroit Mechanical Laboratories, New York city. Both men have now been called to active duty in the Merchant Marine. A unique feature of their machine provided for rapid travel up to the parts, slow cutting speed, rapid return travel, and stop for work reloading.

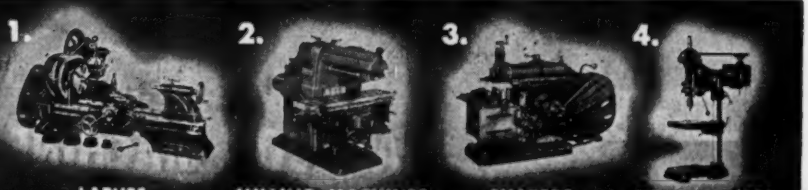
"YANKEE INGENUITY" our friends, and enemies, across the water would call it. Certainly no other machine quite like this one has ever been built. And all because two engineers put some solid engineering gray matter to work — accomplishing for $1,100 what might have cost $10,000 if developed by the usual methods.

They took a 54" Atlas lathe bed, 10" lathe parts, added a magnetic controller, solenoid valves, special switches, shipper rod, hydraulic cylinder and piston — and came up with this "gang" lathe to handle simultaneous machining on three parts with great savings in time and costs.

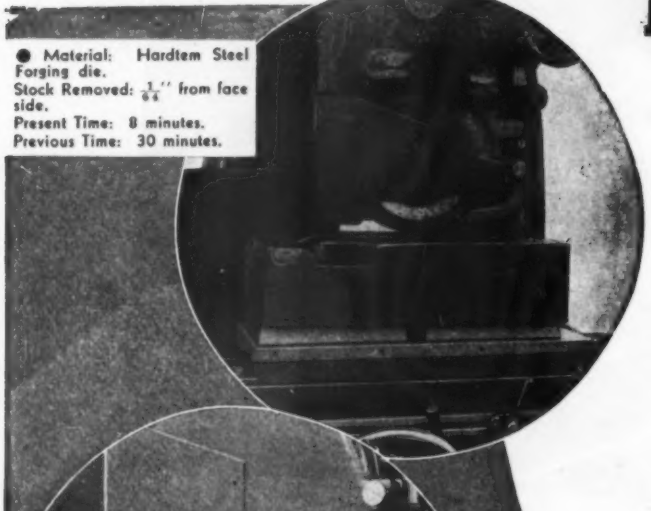
If you are retooling for new contracts, or making reconversion plans, keep in mind the proven precision and adaptability of Atlas tools. The latest catalogs will give you the specifications you need.

ATLAS PRESS COMPANY 304 N. Pitcher Street, Kalamazoo 13D, Michigan

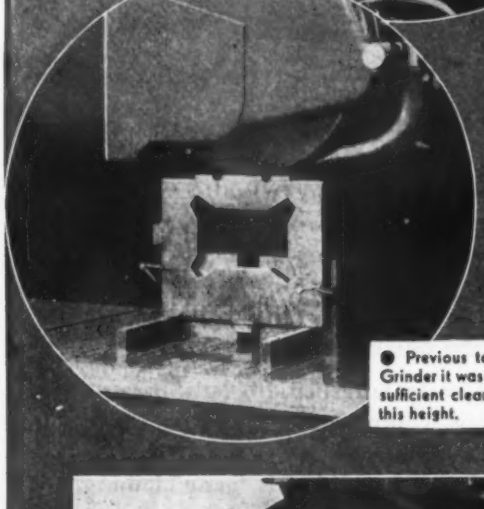
Atlas 4 TOOL TEAM FOR SMALL-PARTS MACHINING



'TIME' OUT FOR DIE RECONDITIONING HELD TO A MINIMUM



● Material: Hardtem Steel Forging die.
Stock Removed: $\frac{1}{64}$" from face side.
Present Time: 8 minutes.
Previous Time: 30 minutes.



● Previous to obtaining Mattison Grinder it was not possible to obtain sufficient clearance to grind dies of this height.

A GREAT variety of die work can be speedily and easily handled on the Mattison Surface Grinder. Its large capacity, ability to hog off stock and high power, keeps the 'time out' periods to a minimum.

A few examples of die jobs ground on the Mattison at a considerable saving in time, are shown on this page. Die shown in the lower left hand corner was ground with leader pins in place at ⅓ of former time. Wheel and spindle clearance of Mattison Grinder is sufficient to handle this type of work with ease, eliminating time required for disassembly and alignment when leader pins are removed.

For further data regarding use of Mattison Grinders for reconditioning dies, ask us to send you set-up sheets on this subject.

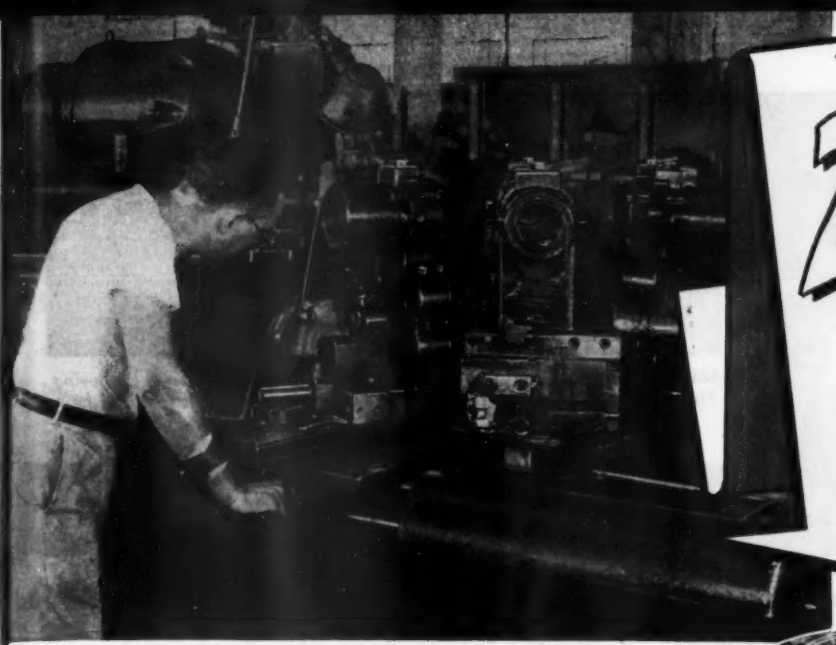
● Die is 20" x 24". Three-quarters of width is ground, then die is reversed on magnetic chuck and remainder of surface ground. Time 20 minutes.

● Time is saved by grinding dies with leader pins in place.

SET-UP SHEET
Containing complete information regarding die grinding jobs will be sent upon request.

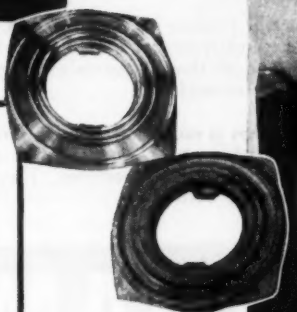
MATTISON MACHINE WORKS, ROCKFORD, ILL., U. S. A.

25 OPERATIONS IN LESS THAN 24 MINUTES

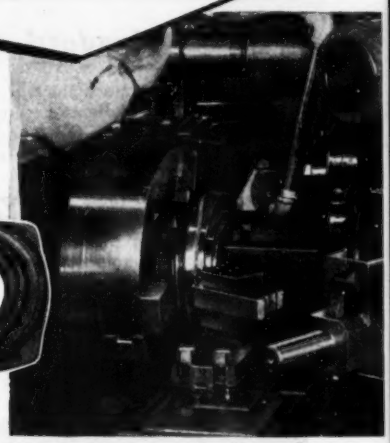


(Above) 2F Foster Fastermatic tooled to produce speed reducer adaptor in less than 24 minutes. Turret faces are tooled for multiple operations and combined cuts.

(Right) After machining, note number and variety of finished operations.



Adaptor forging before machining.



Close-up showing speed reducer adaptor chucked for multiple operations.

Fastermatic Turns and Bores Reducer Part Using 1 Speed and 6 Feeds Which Change Automatically . . . Multiple and Combined Tooling Used on Cross Slides and Turret

Twenty-five machining operations are automatically performed on this intricate speed reducer adaptor and average less than one minute for each operation. The front cross slide with multiple tools performs four rough facing operations in the first operation. Simultaneously, the turret rough turns two diameters and rough bores two diameters. Each turret face is tooled to make similar productive operations.

How Hydraulic Feeds are Obtained

After determining the six feeds necessary for the 25 operations, standard cams mounted on a cam drum are adjusted to give the correct rates of feed. Separate and independent feeds for each face of the turret can be obtained. Hydraulically actuated, these feed rates are infinite in number and because of this are extremely adaptable to various jobs. They are easy to set and once the feeds and speeds are determined, the machining cycle is completely automatic. All the operator has to do is load, start the machine and unload.

How to Increase Your Production

In your own plant now or in the future, you may have chucking machine problems which can be solved by Foster engineers. They will gladly show you how the Fastermatic with its various speeds and infinite hydraulic feeds can produce more parts for you in less time and to closer limits. This engineering assistance is furnished without obligation.

PRODUCTION FACTS

Machine—2F Fastermatic Turret Lathe.

Attachments—2 turret facing slide tools—1 turret facing attachment.

Part—Speed reducer adaptor.

Material—Steel forging (Rockwell "C" 34-36).

Holding Method—3-jaw pneumatic chuck.

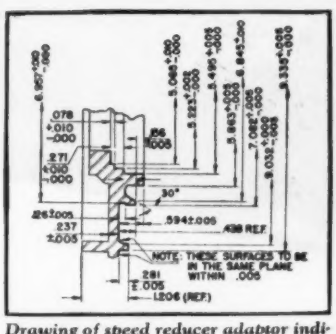
Speeds—Six positions 126 r.p.m.

Feeds—1st Position... .0109 4th Position... .0114
2nd Position... .0051 5th Position... .0055
3rd Position... .0113 6th Position... .0107

Machining Time—23 minutes, 37 seconds.

Loading and Unloading Time—43 seconds.

Floor-to-Floor Time—24 minutes, 20 seconds.



Drawing of speed reducer adaptor indicating dimensional limits.

Get these *FREE* Production Facts *NOW*

This new Fastermatic Catalog gives important information on actual cases. Write today to Foster Division, 1100 Beardsley Ave., Elkhart, Ind., for your free copy.

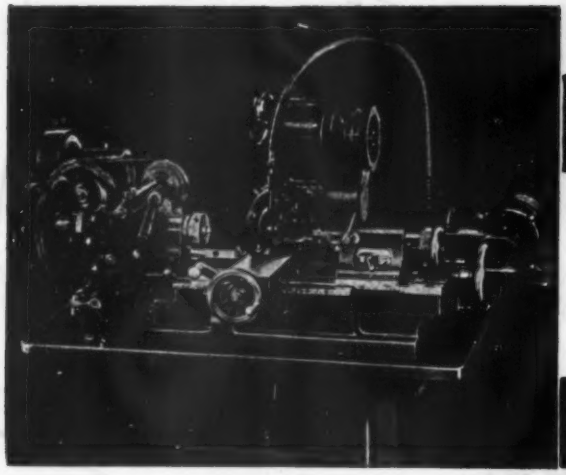
INTERNATIONAL MACHINE TOOLS

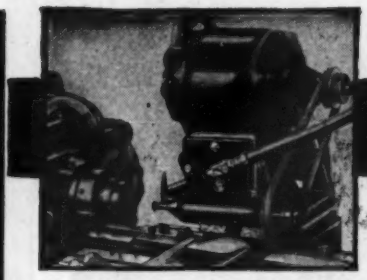
Foster Division - Elkhart, Indiana

INTERNATIONAL DETROLA CORPORATION

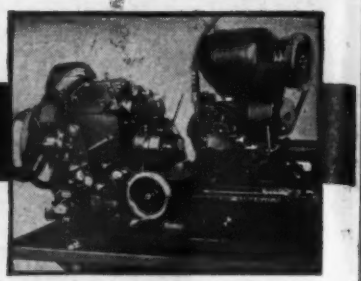
DETROIT, MICHIGAN • ELKHART, INDIANA • INDIANAPOLIS, INDIANA

FOSTER FASTERMATICS • LIBBY HEAVY DUTY TURRET LATHES • STANDARD TOOLS • SUPERFINISHING MACHINES • SPECIAL MACHINE TOOLS





Machine equipped with Internal Threading Attachment having special motor driven cutter head.



Machine equipped with Relieving Head. Lead screw is replaced by a special work head.

WALTHAM THREAD MILLERS

Produce standard and special thread forms with utmost precision and speed

These versatile machines will produce V, N, Whitworth, Buttress and other thread forms accurately and at a high rate of production. Regardless of the type of thread, convenience, speed and high precision are definitely assured.

The capacity of these machines is such that precision threads and small worms can be produced up to 2" in diameter. However, they will swing pieces as large as 3" diameter. They can be furnished for single or multiple cutter use.

An important feature is the use of three motors — for speed, feed and oil respectively — which permits individual speed change and reverse for both cutter and work and a constant speed for the pump. All motors are controlled from a single start and stop station.

• • •

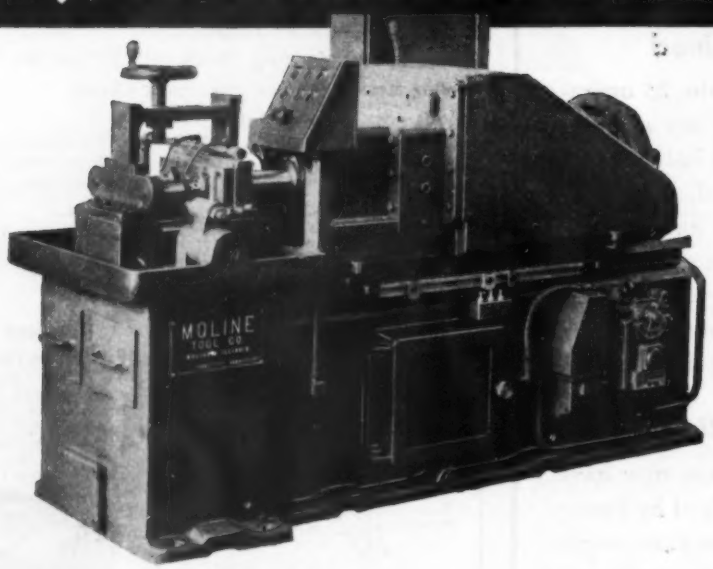
Write for Bulletin 244A

WALTHAM MACHINE WORKS

WALTHAM, MASS.

WALTHAM

This HOLE HOG features Trouble-Free Service



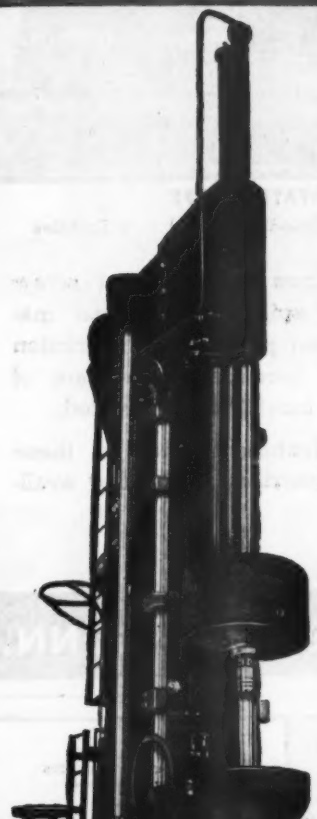
A Moline MR127 Horizontal Hydraulic Feed Machine of the type shown here has been giving trouble-free service since 1937 in a rail yard of one of this country's more progressive transportation systems. Two bolt holes at a time are drilled rapidly in the ends of rail sections while they are held in the fixture which is built to receive rails from either side and to locate them properly. As is the case with all Moline machines, it is designed to be most effective in performing the work for which it is intended and is, therefore, the most efficient machine for that particular job.

MOLINE TOOL CO. HOLE-HOG MOLINE, ILLINOIS

MOLINE TOOL COMPANY

MOLINE, ILLINOIS

There is a BARNESDRIL Honing Machine For Practically Any Requirement



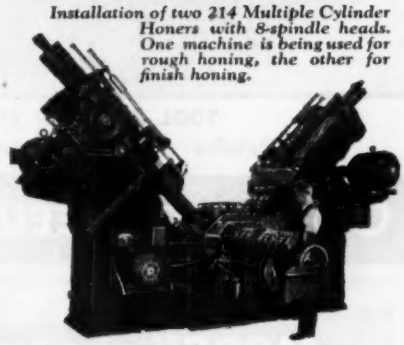
● Whatever your honing requirements may be, you can select the best machine for the job from the extensive BARNESDRIL line. It includes more than 18 different sizes and types of self-oiling, hydraulic honing machines.

BARNESDRIL Honers are built in vertical, horizontal, angular or multiple spindle types, for light, medium or heavy-duty work. Special honing machines are also available for external as well as internal honing.

Many classes of work require only simple methods of holding the workpiece while honing, but on production work, or in the case of irregularly shaped pieces, BARNESDRIL is equipped to supply the necessary work-holding fixtures and accessories for doing the job. In this case the machine is supplied as a complete unit ready for production.

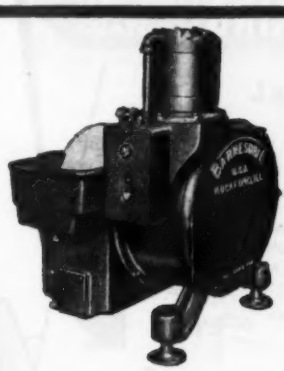
Take your honing problems to BARNESDRIL engineers. Their recommendations will assist you in selecting the machine that will give you the accuracy, finish and economy you desire.

Installation of two 214 Multiple Cylinder Honers with 8-spindle heads. One machine is being used for rough honing, the other for finish honing.



BARNESDRIL *Duplex 45° Angle Multiple Self-Oiling Hydraulic Internal Honing Machine.*

BARNESDRIL *No. 4030 Vertical Hydraulic Honing Machine.*



BARNESDRIL MAGNETIC AUTOMATIC COOLANT SEPARATOR

This new BARNESDRIL Separator automatically removes "swarf" and metallic particles, through magnetic attraction, from honing and grinding coolants. All metallic particles are attracted by magnetic drum and scraped off as drum rotates. BARNESDRIL Separator is easily installed and prevents marring or scratching of finished work. Send for Bulletin A-151 for further details.

FREE HONING DATA

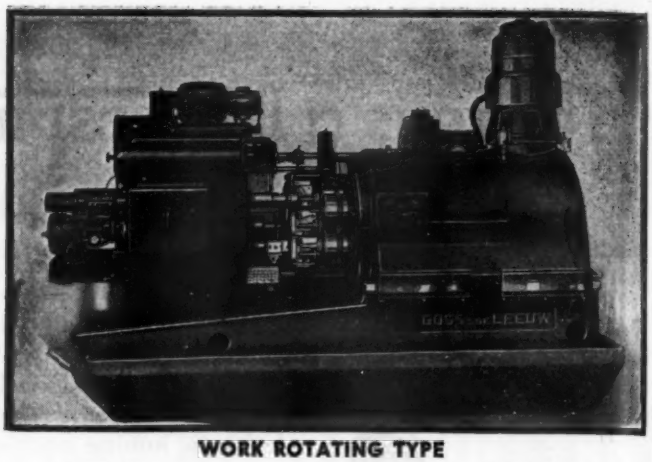
Your free copy of Bulletin A-121, containing complete technical data on the BARNESDRIL honing process and descriptions and specifications of the BARNESDRIL line of honing machines, is available now.

BARNESDRIL *No. 12 Horizontal Hydraulically Reciprocated Honing Machine.*

Barnes Drill Co.

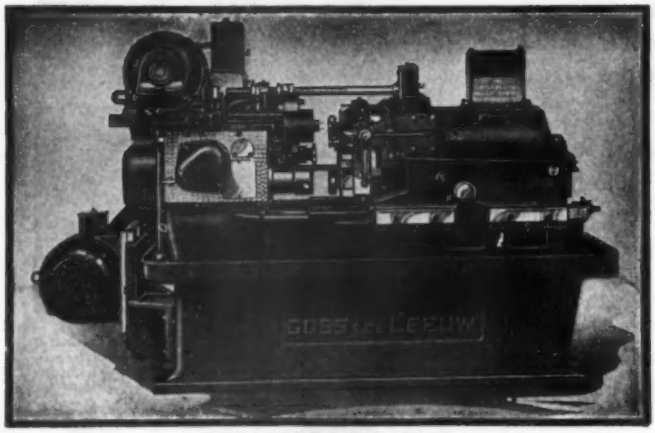
830 CHESTNUT STREET
ROCKFORD
ILLINOIS, U.S.A.

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES



WORK ROTATING TYPE

5 Spindles • 6 Spindles • 8 Spindles



TOOL ROTATING TYPE

4 Spindles • 5 Chucking Positions

Both types of machines provide lead screw threading. Oversize spindles on these machines are mounted on pre-loaded anti-friction bearings. Ways are hardened: gears are of chrome-nickel steel, carefully heat-treated.

The many modern features offered in these machines are fully described in catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

MOREY TURRET LATHES

for BAR *or* CHUCKING { UNIVERSAL or PLAIN

3 UNIVERSAL

For bar stock up to 1½" in diameter
10" turning length
16½" swing over bed
Infinite spindle speeds: 55 to 1800 RPM. constant speed motor, 1200 RPM
AVAILABLE ALSO WITH PLAIN CROSS SLIDE
Ask for Circular 727A

2 PLAIN-GEARED

For bar stock up to 1" in diameter
Turning length 6½"
Swing over cross slide 6"
Swing over bed 14"
Infinite spindle speeds:
Minimum of 60 RPM.
Maximum of 2000 RPM.
Constant horsepower at all speeds.
Ask for Circular 629A

4 UNIVERSAL

For bar stock up to 2" in diameter
12" turning length
19½" swing over bed
Infinite spindle speeds: 35 to 1500 RPM. constant speed motor, 1200 RPM
AVAILABLE ALSO WITH PLAIN CROSS SLIDE
Ask for Circular 736A

EARLY DELIVERY

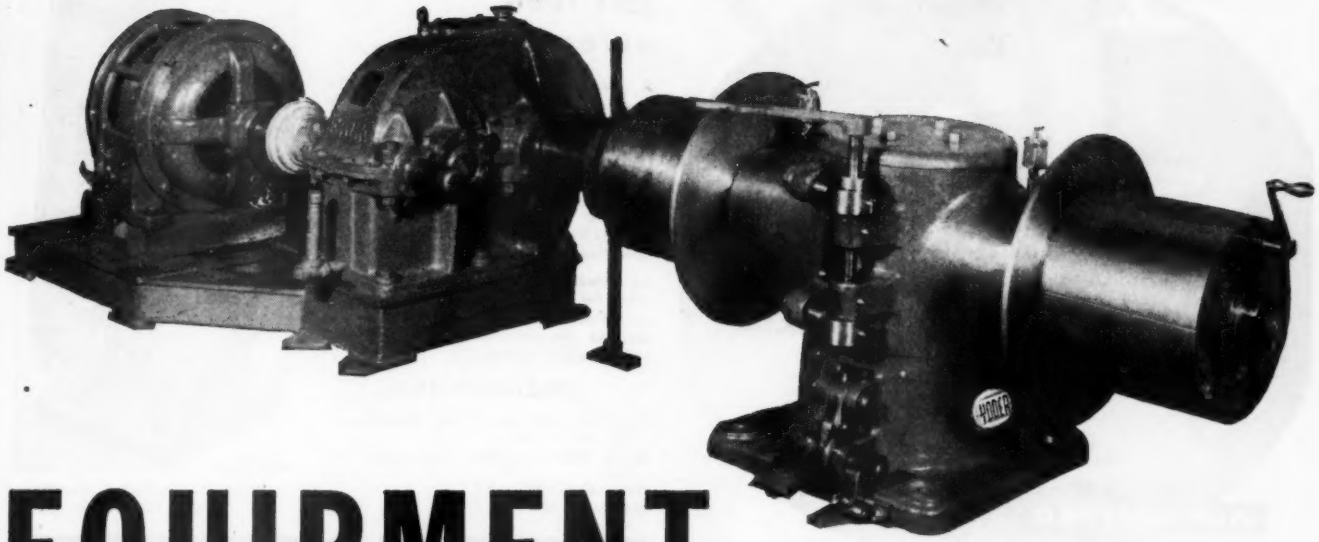
- INFINITE SPINDLE SPEEDS —Electrically Selected—
- DIRECT BELT DRIVE AVAILABLE AT HIGH SPEEDS ELIMINATES GEAR MARKS (patents applied for).
- GEARED SPINDLE SPEEDS INSTANTLY AVAILABLE THROUGH MULTIPLE DISC CLUTCHES.
- SPINDLE MOUNTED ON TIMKEN BEARINGS.
- RIGID—WITH SUFFICIENT POWER TO TURN AT THE HIGHEST SPEEDS AND FEEDS MODERN TOOLS WILL WITHSTAND.
- SPINDLE SPEEDS AND POWER FEED CHANGES WITHIN EASY REACH OF OPERATOR.

ARMY NAVY

THE DESIGN OF THE MOREY No. 2, 3 and 4 TURRET LATHES ARE BASICALLY ALIKE. EACH MACHINE IS ENGINEERED FOR THE SIZE WORK IT IS DESIGNED TO HANDLE.

DESIGNED AND BUILT BY
MOREY MACHINERY CO., INC
410 BROOME STREET, NEW YORK 13, N. Y.
PLANT: 4-57 26TH AVE., ASTORIA 2, NEW YORK

COIL HANDLING



EQUIPMENT By *Yoder*

DEVELOPMENT of coiled strip in a constantly increasing variety of widths, guage and material has been an important factor in the advancement of high speed production in stamped, punched, drawn and roll-formed metal products. Yoder has specialized in the engineering and building of special handling equipment from the early days of strip making.

Today Yoder builds coil handling equipment as varied as industry's needs, from simple ball-bearing coil boxes to cone type uncoilers with drag generators and from simple stock reels to huge tension reels for steel mill use. The patented double-swivel type recoiler, shown above, handles single or multiple coils up to 6,000 pounds, is made so that coils can be unloaded from one side while the other is recoiling . . . The coil box at right is the simplest form made, ball bearing, easy to load, compact, suitable for serving a wide variety of strip-fed production machines. There are many other types.

These machines may be had with Yoder pinch-roll feed stands, levellers, edge trimmers, or as integral parts of complete Yoder-built slitting or roll-forming lines. If your coil handling need is special, Yoder can engineer a unit for you, based upon the most complete experience in the industry.

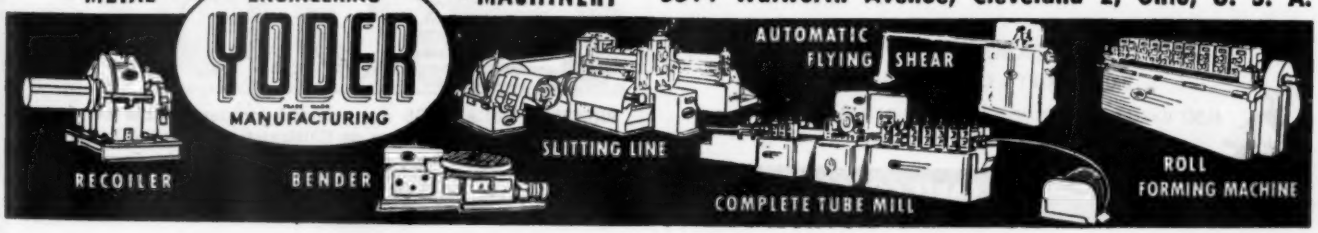
For engineering consultation or product information write to

THE YODER COMPANY

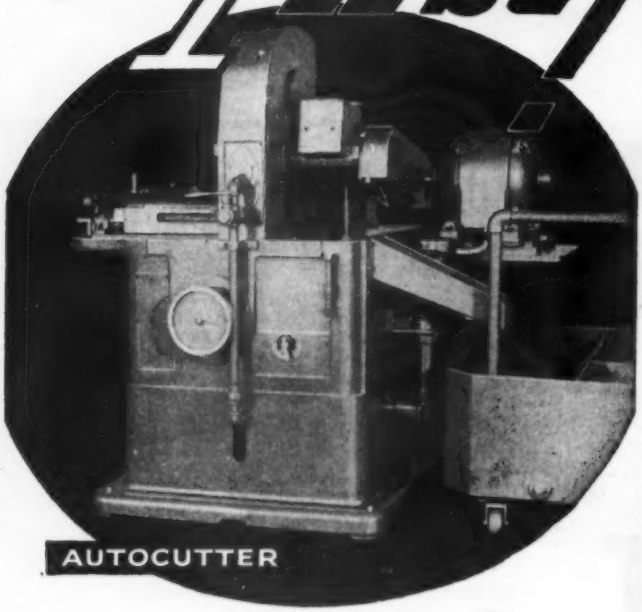
5514 Walworth Avenue, Cleveland 2, Ohio, U. S. A.

METAL • WORKING • PRODUCTION • MACHINERY ENGINEERING

YODER MANUFACTURING



IT'S A First



Yes, this **CAMPBELL "MODEL 700"** is the first *fully automatic* abrasive cutting machine ever built. Coming from **CAMPBELL**, manufacturers of the most complete range of abrasive cutters, that's big news.

This **"700"** is "first" another way. It is the opening announcement of **CAMPBELL'S** post-war program of development, based on wartime improvements all through the line. Other announcements will follow.

Maybe there's a way a **CAMPBELL ABRASIVE CUTTER** could speed up or economize your production. It's easy to find out.

WHY NOT DO THIS?

Write and tell us (1) the range of sizes, (2) kind of material, (3) length of cutoff pieces, (4) length of stock before cutting, (5) tolerance for length of cut pieces and (6) hourly production requirement. With this information, **CAMPBELL** engineers can recommend production procedure and work up cost sheets for you.

Campbell

ABRASIVE CUTTING MACHINES

ANDREW C. CAMPBELL DIVISION
BRIDGEPORT • CONNECTICUT

ALSO MAKERS OF A COMPLETE LINE OF NIBBLING MACHINES

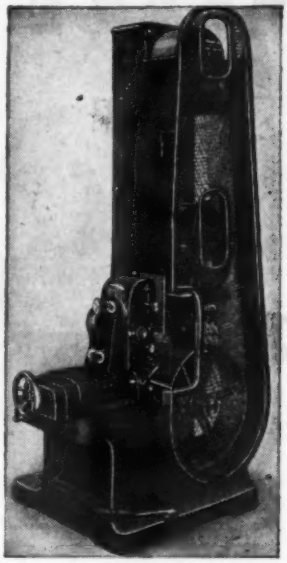
ACCO
AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

"PRODUCTION" *Type A*
HIGH SPEED POLISHING MACHINE

No Centering or Chucking— just feed automatically . . .

A power feed provides the means for feeding cylindrical work automatically through this machine which represents the highest development for polishing and finishing metals, fibre, rubber, wood, etc. The automatic feeding and holding devices, together with the abrasive belt, assure a mechanical finish far superior to anything yet obtained with hand operations.

An attachment is available which provides for automatic feeding of tapered cylindrical work. Hand feed may be used on this machine for finishing flat and irregular shapes.



SPECIFICATIONS

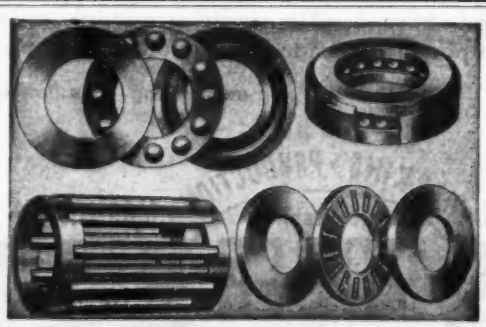
Capacity (with power feed attachment) ¼" to 6" dia.
Speed leather cushion belt—6300' per min.
Floor space—40" x 50"
Motor—10 H.P.

Write for illustrated literature giving full details

PRODUCTION MACHINE CO.
Manufacturers of Drilling Machines, Tool Grinders and Hand and Automatic Polishing and Grinding Machines.
GREENFIELD, MASS., U. S. A.

EIGHT SPEEDS
from 600 to 9000 R. P. M.
INSTANTLY AVAILABLE
for Drilling Small Holes
on the LELAND GIFFORD No. 1
MOTOR SPINDLE DRILLING MACHINE
Bench or Floor type — 1 to 6 spindles

LELAND GIFFORD
WORCESTER, MASSACHUSETTS



B & R B

PRECISION BEARINGS are selected for dependable service. Bearings of standard sizes as illustrated are carried in stock. Catalog and discounts furnished on request.
THE BALL & ROLLER BEARING CO., Danbury, Conn.

CUTS EVERYTHING...ALL OVER THE PLANT...

Wells No. 8— never gets tired!

SPECIFICATIONS
WELLS NO. 8

CAPACITY: Rectangular . . . 8"x16"
(Special Guides) . . . 5"x 24"
ROUNDS: . . . . . 8" diameter
MOTOR: . . . ½ H. P., current optional
SPEEDS: . Selective 60, 90, 130 feet per minute
WEIGHT: . Approximately 750 pounds

Products by Wells Are Practical

• This Wells No. 8 Metal Cutting Band Saw has proved itself a handy tool to have in any man's metal working plant. Sturdily made, simply designed, it keeps cutting — most all shapes and types of metals — wherever you need it. It frees large production units for other work. It cuts close—removes a minimum of stock and operators like it because it's easy to use. Then, too, this Wells is portable. You save time and labor by moving the saw to the work. Check up. You'll find a spot in your plant for a Wells No. 8. See your supply distributor for details.

Wells SAWS
THE SIGN OF SERVICE

Wells

Products by Wells are Practical

METAL CUTTING BAND SAWS

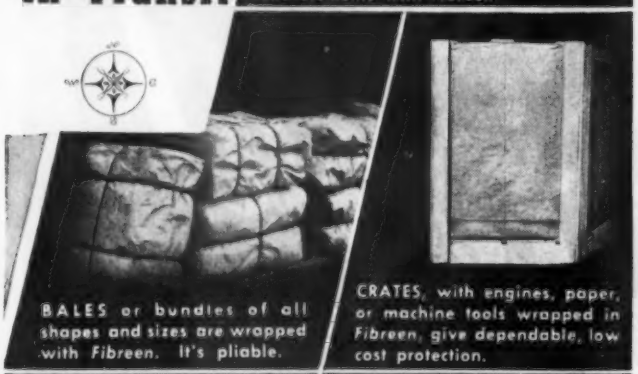
WELLS MANUFACTURING CORPORATION
505 ROOSEVELT ROAD, THREE RIVERS, MICH.

Use FIBREEN

SISAL-REENFORCED WATERPROOF PAPER

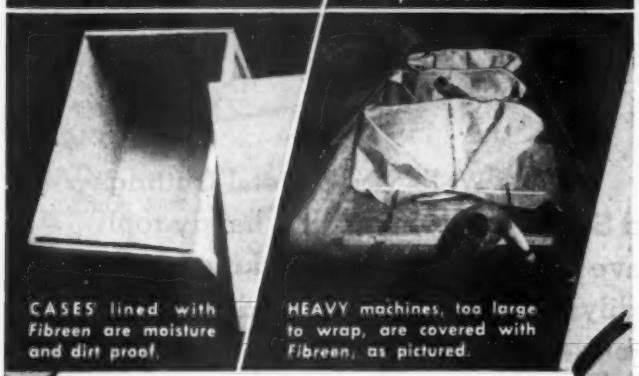
for Dependable Protection in Transit

MACHINES shipped in open cars or stored in the open, are protected from the elements with *Fibreen*.



BALES or bundles of all shapes and sizes are wrapped with *Fibreen*. It's pliable.

CRATES, with engines, paper, or machine tools wrapped in *Fibreen*, give dependable, low cost protection.



CASES lined with *Fibreen* are moisture and dirt proof.

HEAVY machines, too large to wrap, are covered with *Fibreen*, as pictured.

ROLLS of all sizes and weights are easily wrapped with *Fibreen*.

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Offer: Infinite range of threads and feeds. Easy gear adjustment. Independent motor mounting. Short, direct drive. One control for all threads. Ample power for heaviest cuts. Automatic stop for feeds.

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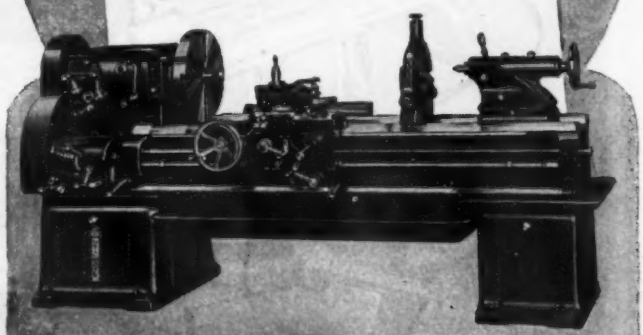

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SMOOTH, RAPID CUTTING OF
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Trimming a metal spinning in a plant where oil tank cars and truck bodies are made.

Especially designed to cut the new, tough materials, the Zephyr is speeding through work in war plants. And, these light-weight materials are here to stay—will be used for thousands of civilian products. The Zephyr cuts them as easily as the Black Widow zooms through flak-infected skies.

Right now and in the future, the DoALL Zephyr can take away your metal cutting worries.

The Inside Story of Zephyr in pictures sent on request.

Right—Zephyr slicing through Butyl.

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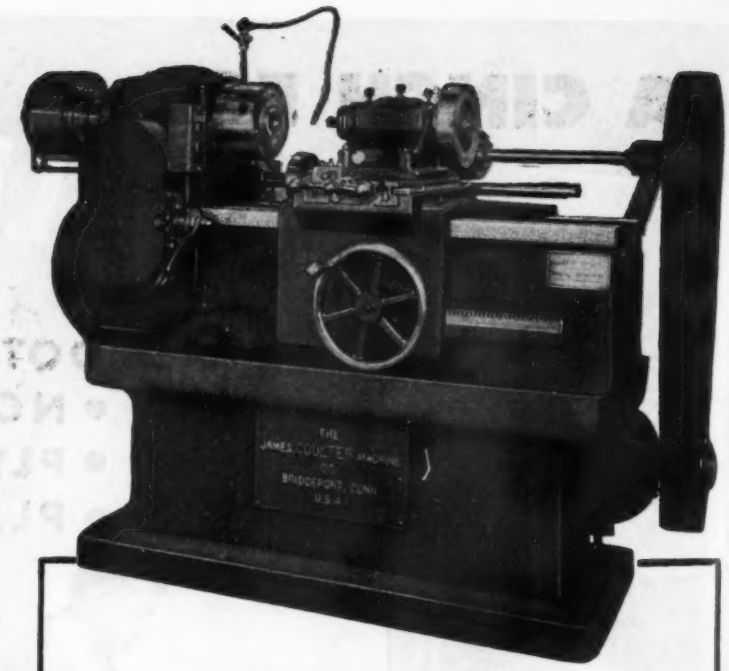
Keep Ahead of DEFENSE DEMANDS *on the PRODUCTION of* EXTERNAL and INTERNAL THREADS



The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

Maximum external thread, 7"; minimum hole depends on smallest hob practical.

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Cap Setting Machine

To the left is shown our new machine used for the upsetting of punches in place and used extensively in the die and tool department of stamping plants. On the right is shown our new machine for cap setting up to 90 mm caps. Fully adjustable for torque. These machines obtainable in vertical and horizontal types ¼ H.P.

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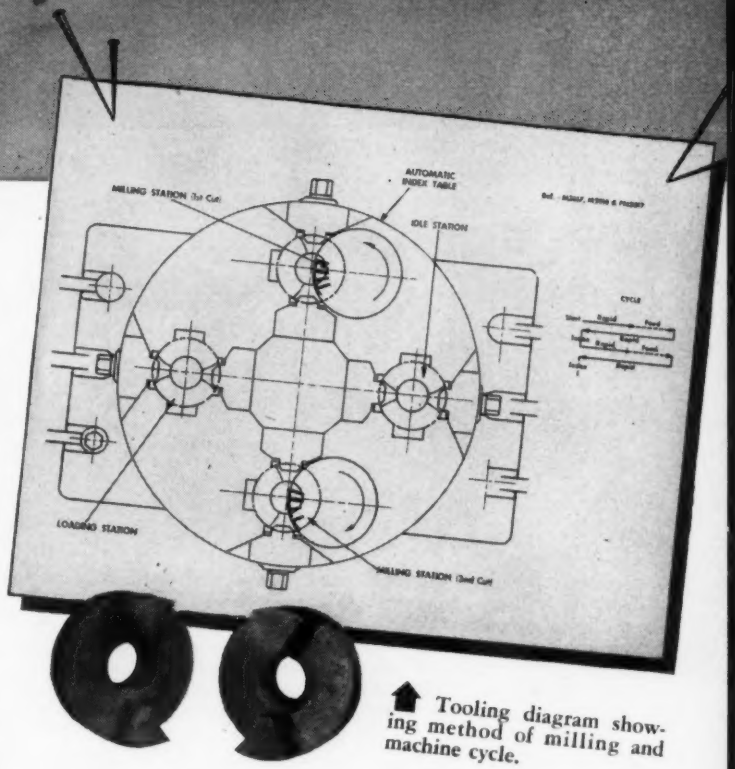


Tooling diagram showing method of milling and machine cycle.

Designed to accommodate a wide variety of special heads and tooling Sundstrand *Standard* Rigidmils are often used to solve special milling production problems.

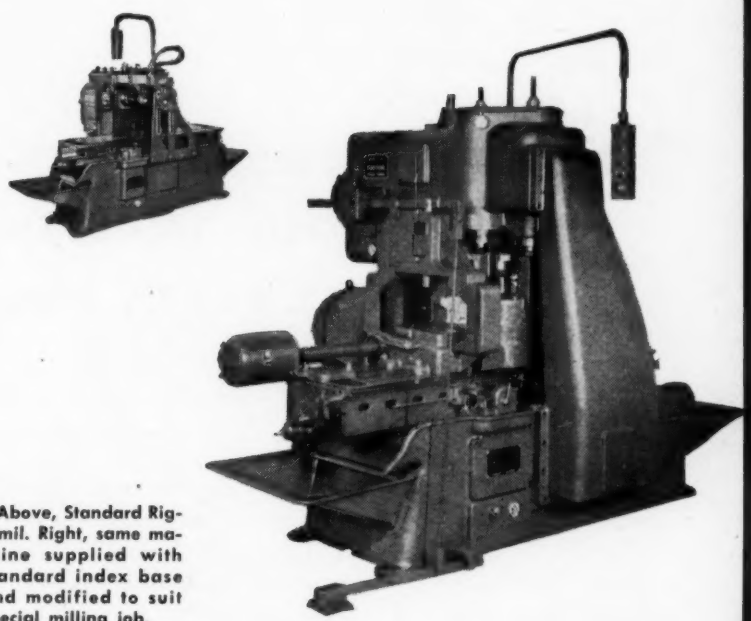
Here's how the Houde Engineering Corporation uses a Sundstrand Fluid Screw Rigidmil on a special milling problem. The shock absorber abutment flange requires milling at high production and to close limits. The Standard Rigidmil has been provided with a special head having two vertical spindles and a special outboard brace. A standard Sundstrand automatic index base with four special work holding fixtures is mounted on the machine table. Operations consist of milling in stations No. 2 and No. 4, see operation drawing.

PRODUCTION INCREASED 40%

In addition to increasing ease of operation and accuracy, production has been increased 40% over the former method. The foot operated lever roughly positions the part prior to clamping—dial indicators facilitate speedy, accurate setting of the cutters.

DIMENSIONS HELD TO .0002" CONSISTENTLY

Application of the standard Sundstrand Automatic Index Base eliminates the need for re-locating the work between operations. Consequently both sides of the flange are held absolutely flat, parallel with each other and within a relative height of .0002".



•Above, Standard Rigidmil. Right, same machine supplied with standard index base and modified to suit special milling job.

HOW SUNDSTRAND ENGINEERED PRODUCTION WILL GIVE YOU ECONOMICAL MILLING

In addition to having designed a wide range of Standard Rigidmils which are easily rearranged to accommodate special milling jobs, our engineers have designed countless special machines for all types of production milling jobs. Call on them without obligation. Write for these descriptive machine bulletins today. Ask for bulletin 134.

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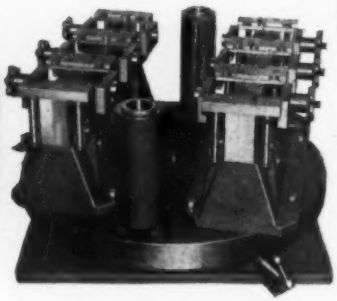
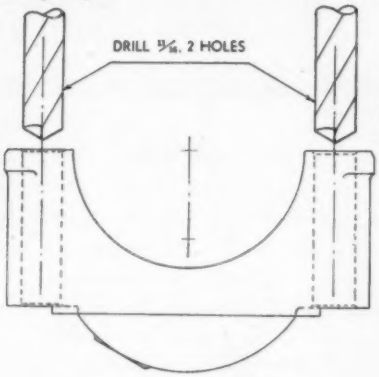
12 Holes Drilled in SIX CONNECTING ROD CAPS in 69 seconds · · · ·



Three different size caps handled in two-station indexing type fixture

Alloy Grey Iron Casting. 11/16" drills; feed 50' per minute; .009" penetration per revolution at 278 r. p. m.; depth of cut 2⅜". This job is an example of what can be done in faster, lower cost production with Hoefer Multiple Spindle Heads. Your requirements can as easily be developed by our engineers. Write and tell us about your job.



HOEFER'S WHOLE BUSINESS IS HOLES

• Twelve-Spindle Head and Fixture. Head is of Universal Joint Adjustable Type, arranged for Locator Plate (not shown) for rapid setting of spindles to any required hole layout within range of head. Fixture is of two-station Indexing Type containing two sets of Work Holding Units, each set accommodating six Connecting Rod Caps (three different sizes). Six Caps are being drilled simultaneously while six Work Holding Units are being unloaded and loaded with new parts.

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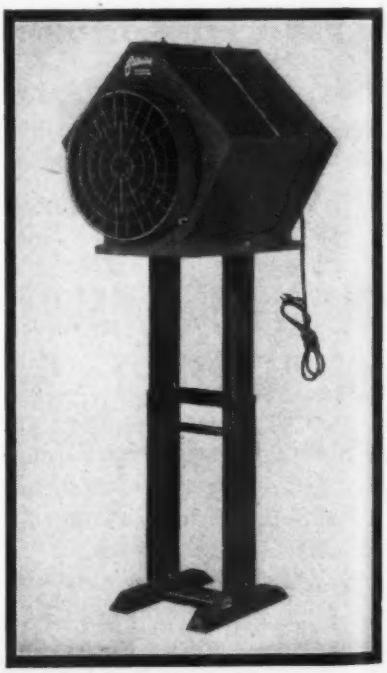

Plant equipment is often expensive, and *none* of it should be wasted during this period of wartime shortages.

Dust that circulates in the air of your plant can ruin expensive machine tools, gages, bearings, etc., yet this dust can be controlled *inexpensively* by the use of Filtaire Portable Dust Collectors. These units can be profitably used in dozens of spots in most plants. They catch the dust in replaceable spun-glass filters—they recirculate warm air within the plant (a good way to save precious coal or oil)—they can be used with grinding and polishing machines of any type without special hoods or piping.

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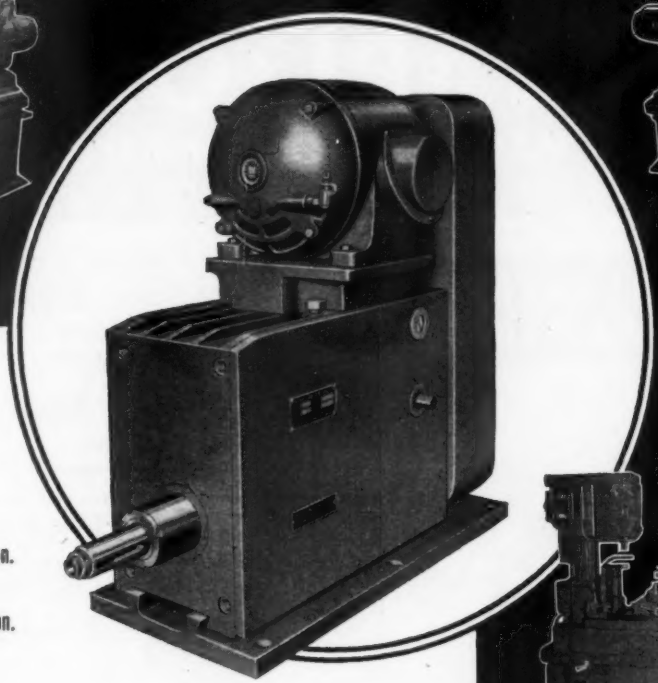

No. 1 Size—
1/2" capacity in cast iron.
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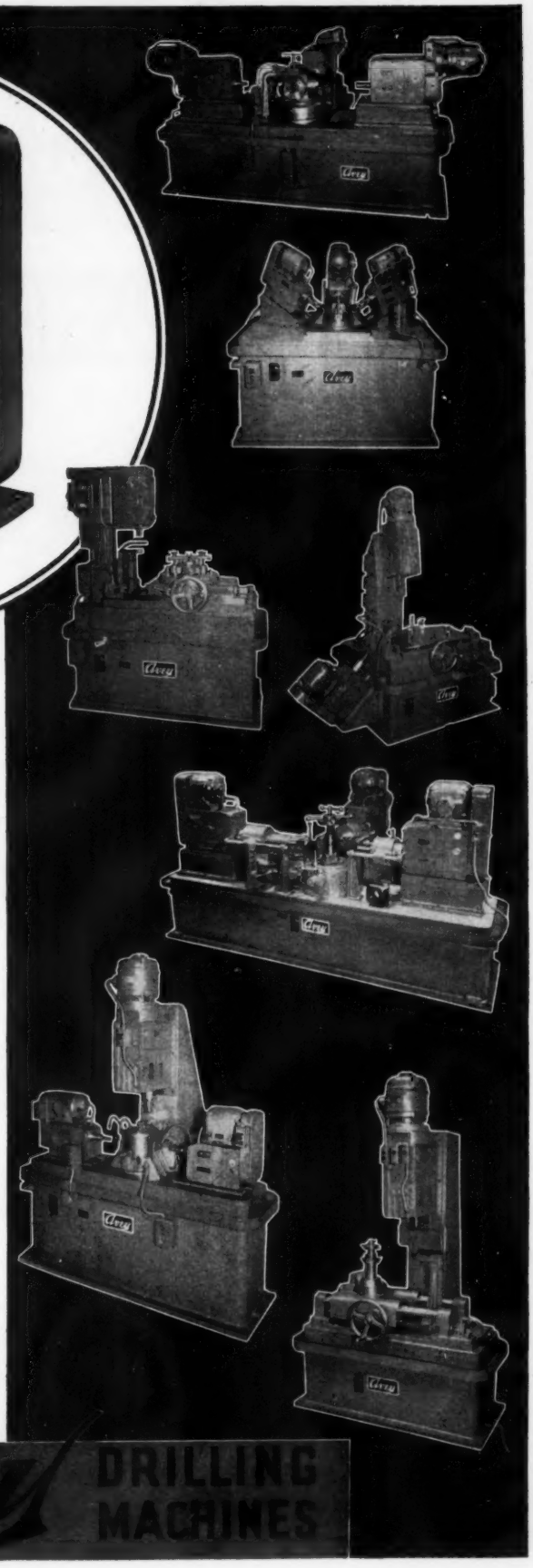
7/8" capacity in cast iron.



Designed for universal applications. Illustrated are *Avey* machines equipped with Cam Feed Units to answer the demand for high production equipment.

This simple unit gives high production at a lower cost. When used in multiples to complete operations, no re-location of parts is necessary, thus producing more accurate work.

Semi-skilled operators will deliver high production accurately, efficiently, with a minimum of supervision.

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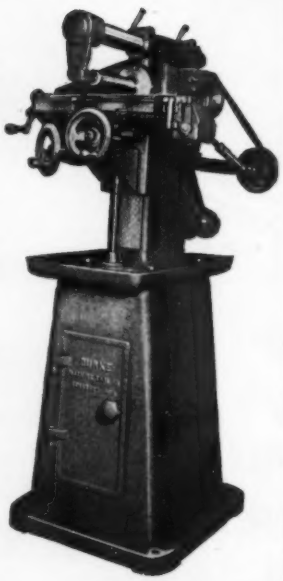
. . . Put Your Small Work on a Production Basis!



Those small, difficult jobs can be handled on a *production basis* with BURKE Motor Driven Milling Machines Nos. 1, 2, 3, & 4. Primarily, this is because BURKES have been *specially designed and built* to do smaller milling jobs efficiently and economically.

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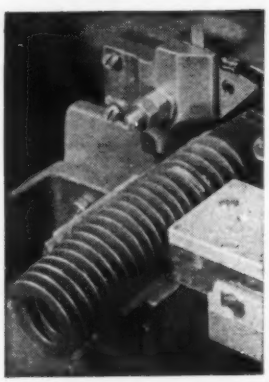

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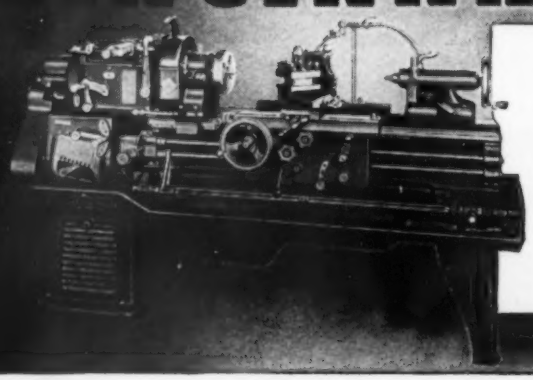
CINCINNATI LATHES



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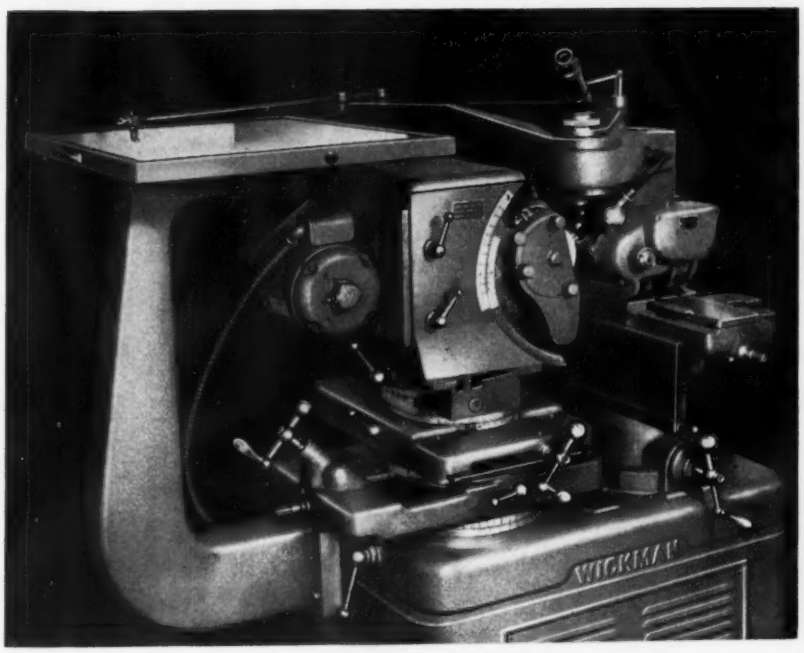
Today, flat and circular form tools, punches and die segments, profile gages, special cams, templates, and many other irregular parts are being ground on this machine "directly from the drawing" and from a wide variety of materials including tungsten-carbide. Full information on how the Wickman Profile Grinder will fit into your production is yours for the asking.



Shown above is the Wickman Profile Grinder on which is mounted the circular grinding attachment supplied for use on cylindrical work such as circular form tools.

The WICKMAN PROFILE GRINDER

THE Wickman CORPORATION

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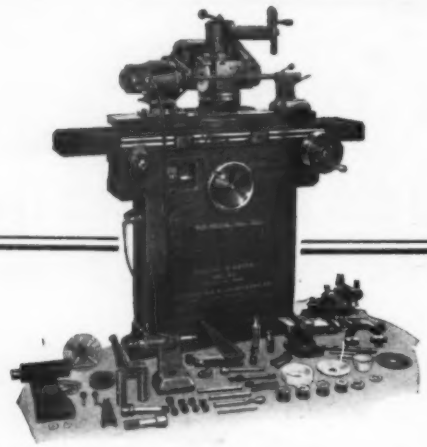

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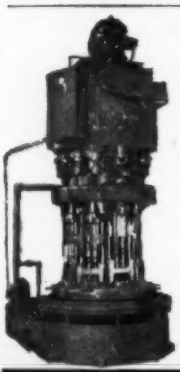

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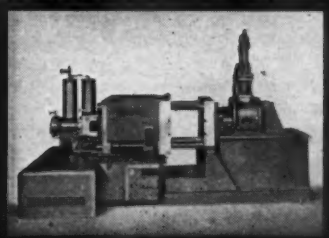

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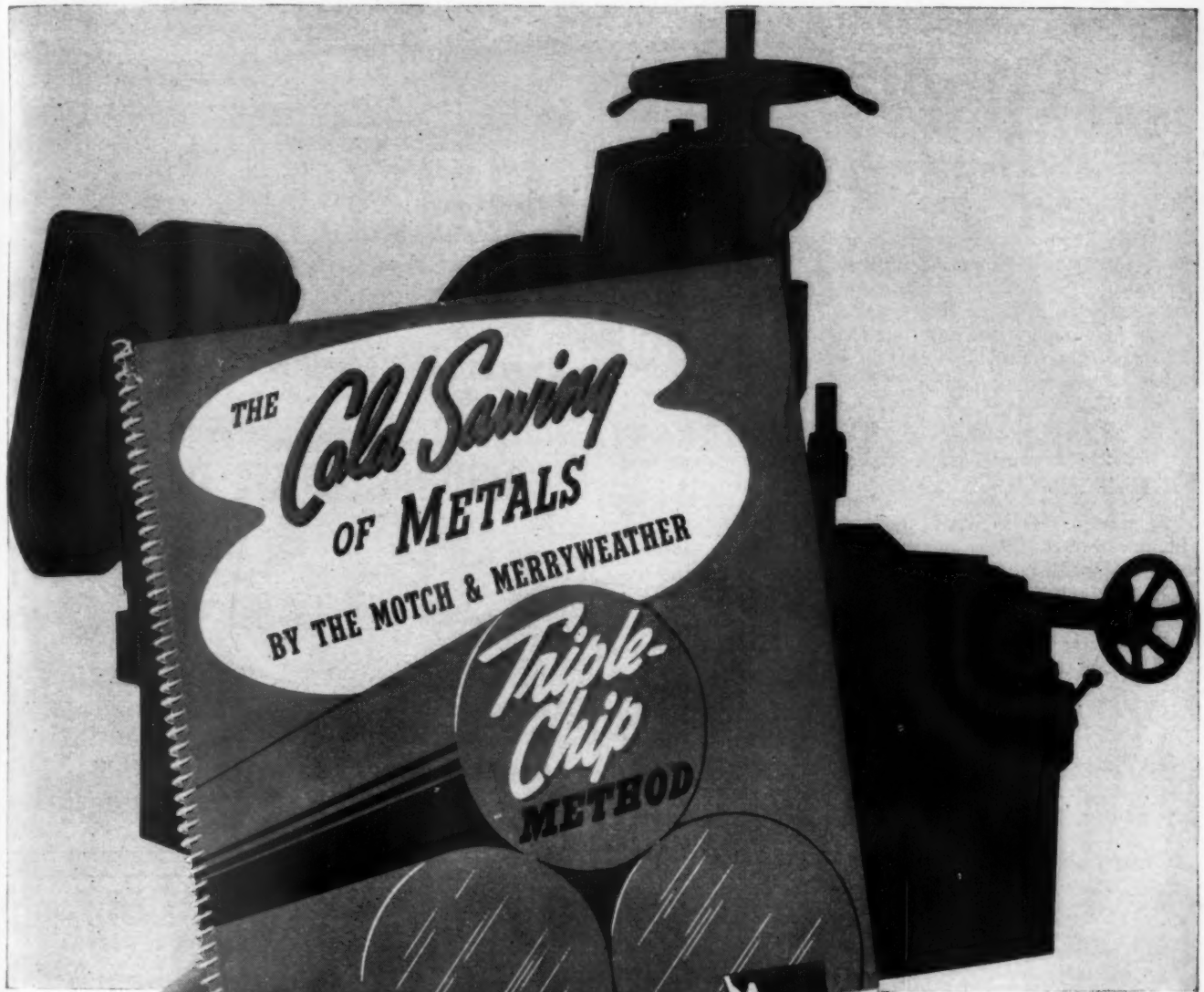

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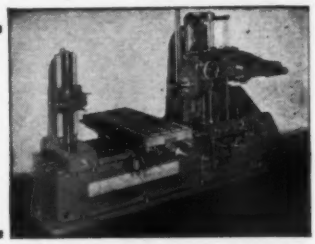

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We manufacture a complete line of Dressers and Cutters. Write for copy of catalog "A".

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For cutting internal keyways, slots or splines 1/16" to 4" wide and up to 60" long. Fast—Accurate—Flexible. Write for particulars and catalog on machine for your work.

Giant KEYSEATERS

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"WORLD'S FINEST CARBIDE"

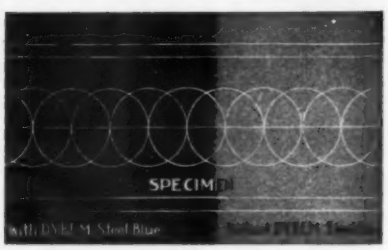
Tantalum-Tungsten *CARBIDE* Tools, Blanks and Dies.
***TANTUNG* Cast Alloy Cutting Tools.**

VASCOLOY-RAMET CORPORATION
NORTH CHICAGO • ILLINOIS

DYKEM STEEL BLUE

STOPS LOSSES

making dies & templates



simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

THE DYKEM COMPANY, 2301 B N 11th St., St. Louis, Mo.
In Canada: 444 Pacific Ave., Toronto, Ont.

DESIGN / PRODUCTION / MAINTENANCE

Pictured above is a group of engineered assemblies of American Flexible Metal Hose, each completed with a type of fitting or coupling to suit a specific application.

Such assemblies become an integral part of a machine or product design and serve in most exacting production and maintenance duties such as for carrying liquids, oils, grease, hot and cold water, steam, semi-solids; for absorbing vibration in feed or exhaust lines, and compensating for misalignment of tappings.

For all-around conveying duties between moving parts, such as the platens of molding presses, laundry presses; supplying steam to automobile tire molds; carrying delicate essential oils from tank to filters; serving as hydraulic oil lines on giant steel strip mills . . . and thousands of other industrial services. . . . American has a style of Flexible Metal Hose specially constructed to do the job.

American Metal Hose Assemblies withstand constant flexing for almost unbelievable periods . . . can be built to take very high pressure. For instance American "Seamless" . . . the flexible tubing with no joints, welds, seams or packing is as leakproof as the seamless rigid tube from which it is made . . . its cost per foot per hour of service is amazingly low.

American Flexible Metal Hose and Tubing has contributed mightily to war work . . . will again find even more widespread use in civilian production than it has in the last 35 years. Ask for available literature . . . get the facts on what it can do for you.

ANACONDA
from mine to consumer

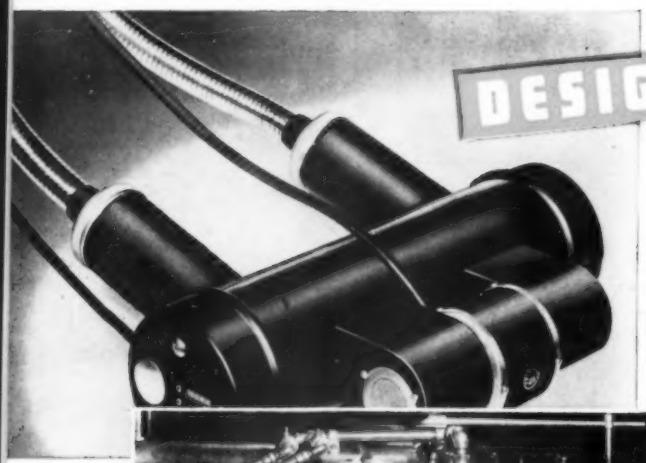
American Metal Hose

AMERICAN METAL HOSE BRANCH of THE AMERICAN BRASS COMPANY

General Offices: Waterbury, Conn. Subsidiary of Anaconda Copper Mining Company

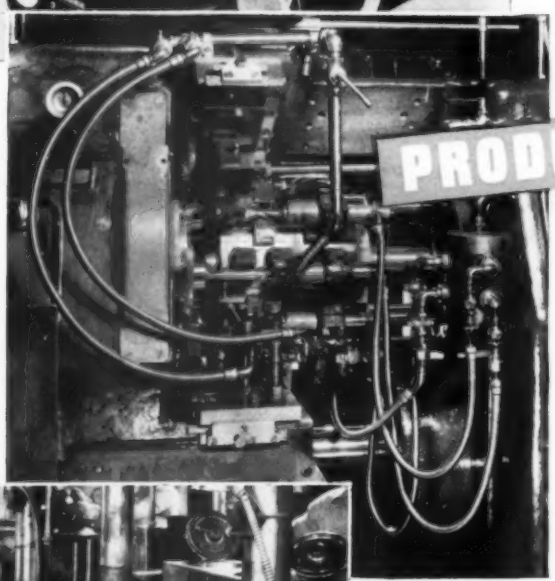
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

FOR BETTER METHODS AND SMOOTHER PERFORMANCE IN *Design, Production* AND *Maintenance* — AMERICAN METAL HOSE



DESIGN....

Machine and Product Designers find many advantages in getting American Metal Hose on their drawing boards "*right* from the start". Appearance is enhanced, connecting and dis-connecting of pipe lines is facilitated, longer service life of machinery is assured. Note the use of "American" to protect cable on this X-ray machine.



PRODUCTION....

Oil feed lines, such as those shown on this multiple spindle automatic Bar machine, must stand up under severe conditions. That is exactly what you may expect and depend upon with all types of "American" Flexible Metal Hose and Tubing. It is equally true of steam, hot water and hydraulic pressure lines that are installed to flex with moving parts. Specify "American" for sure-fire performance, lower service costs, easier installation, and resistance to vibration.

MAINTENANCE....

Machine down-time is minimized when equipment, such as this battery of plastics presses, has flexible feed lines connected with re-attachable couplings, made the "American" way. The lines may be easily changed, or re-located to suit requirements. The maintenance duties of American Metal Hose include blowing of chips, vacuum cleaning of dust, dirt, etc., and insertions in exhaust lines to absorb vibration, expansion and contraction.

There are many places for American Flexible Metal Hose in practically every industrial plant both to improve products and decrease maintenance. Our Engineering Service will gladly make specific recommendations on request.

American Metal Hose Branch *of* The American Brass Company

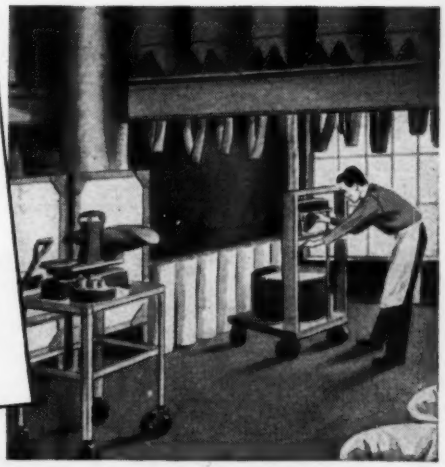
General Offices: Waterbury, Conn. • *Subsidiary of Anaconda Copper Mining Company*

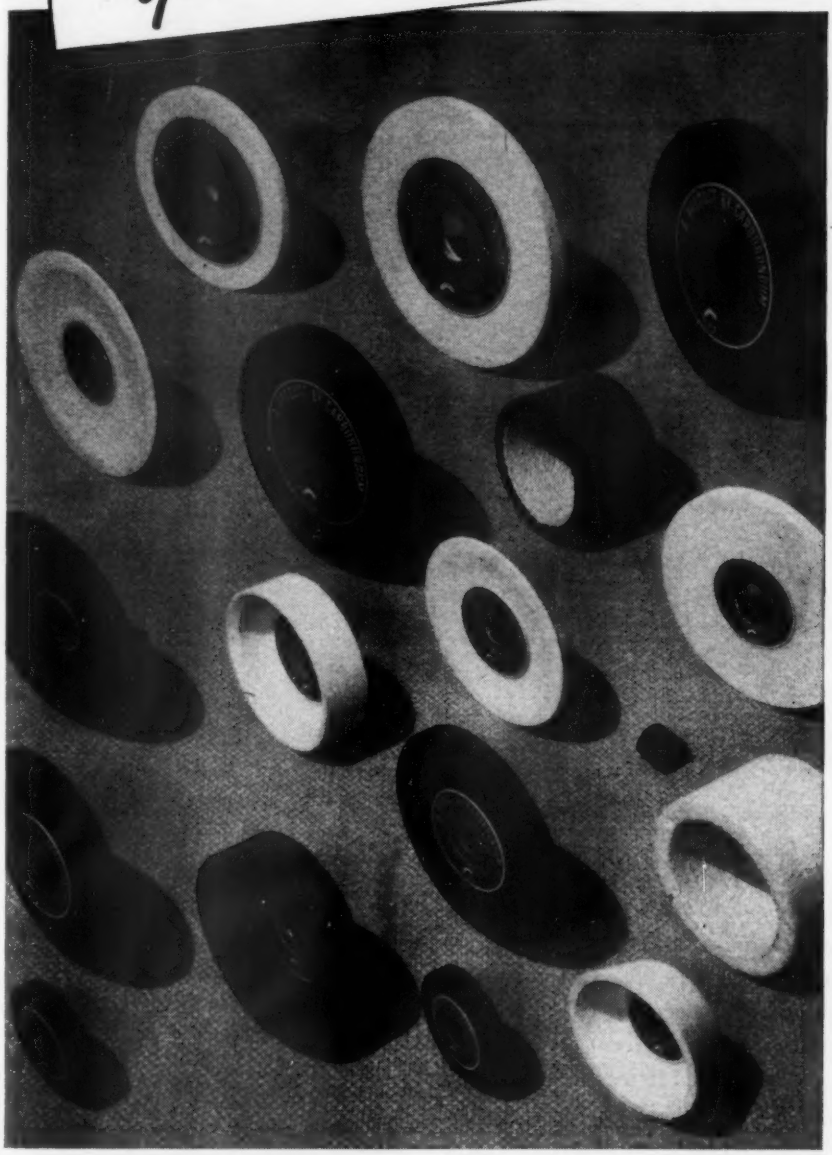
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA

45255

How to take the Guesswork out of your Abrasive Problems!





ONE way is to specify wheels, coated abrasives, grain and "MX" products by "CARBORUNDUM." Each product is produced under rigid standards. Every ingredient is carefully controlled. Every manufacturing process is carefully checked by experienced engineers.

Of course, to select exactly the right abrasive for even the most difficult job, you can always obtain the help and advice of the "CARBORUNDUM" Abrasive Engineer. He's a man whose experience covers abrasives from "A" to "Z." The chances are a "CARBORUNDUM" representative can be a big help to you—he has been to many others.

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THERE IS A PRODUCT BY

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TRADE MARK

FOR EVERY ABRASIVE APPLICATION

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Hi "Q" says . . . *"We're all pulling together to BEAT THE "H..." out of HITLER and HIROHITO"*

● One way this goal can be reached is to provide our boys with ample supplies of war materiel.

At Quality, our part is one of providing the producers of ordnance materiel with a COMPLETE GAGING SYSTEM FOR CARTRIDGE CASE INSPECTION.

This system includes (1) New Gages in all sizes from the largest to the smallest, either empty cases or complete rounds; (2) Gage Inspection Service; and (3) Gage Reconditioning Service.

Standard List Prices are available on 20 MM, 37 MM, 40 MM, 57 MM, 75 MM, 76 MM, 90 MM and 105 MM gages. Other sizes will be quoted on request.

Write today for complete information, without obligation.

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Manufacturers of "Quality" Products

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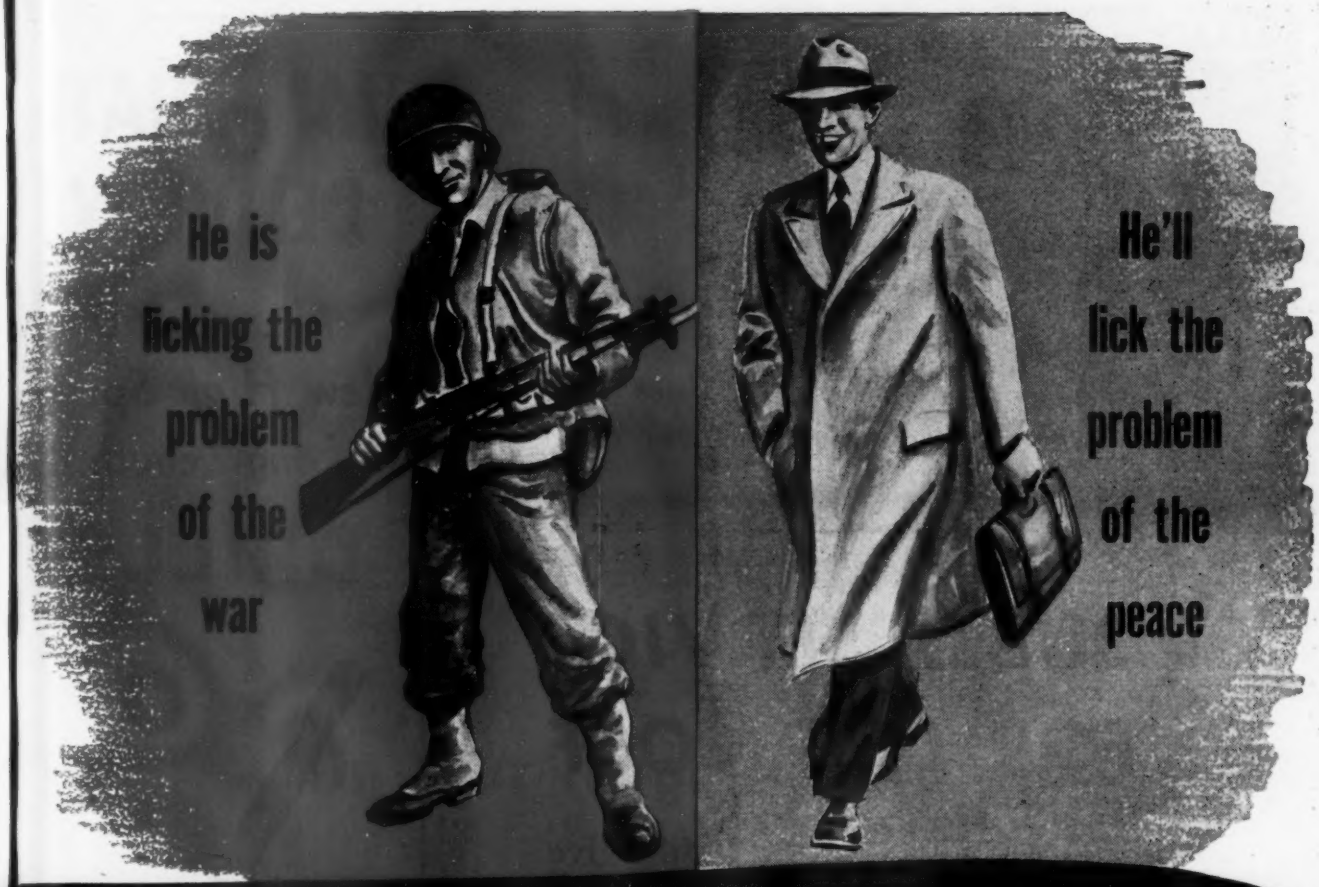

George's own small part will be to help your ISD help you . . .

George was a salesman for your *Industrial Supply Distributor. Today he's one of the reasons the Allies are on top, thanks to his guts and intelligence and ability. It's a big job that he's helping to wind up.

But the job is no bigger, really, than the job of licking the problems of peacetime that are coming. And that's a job where George is admirably qualified to do his part. As he demonstrated so well in the past, George knows sources of supply—he knows how to get materials to you on schedule—he knows how to anticipate your needs. His specialized knowledge means lower production costs for you.

These will be George's contributions to Industry in the postwar world. In the meantime, please continue to work with your *Industrial Supply Distributor. *You'll find it pays to*

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DOUBLE SERVICE ..FOR LESS COST

WELDON Double-End End Mills give you double the service for far less than the cost of two single-end end mills of equal size. Originated by WELDON the Double-End End Mill saves production time, too, because you simply turn it end for end when you want to change the mill.

Because they permit higher speeds and faster feeds with longer tool life, Double-End End Mills insure economy with increased efficiency on your every day production.

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IMMEDIATE DELIVERY

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New High Speed
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No. by Gage	*Length*	*Our Price Net Each*
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If you buy 60 drills or more — 20% discount

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MACHINERY EXCHANGE
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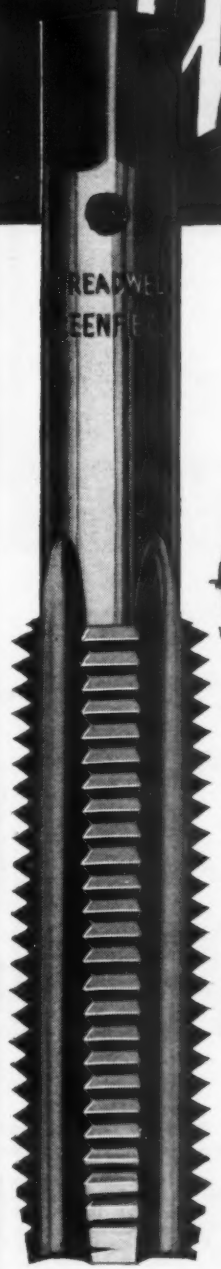
Threadwell



The TAP To Try On Your Toughest Threading Jobs

Try it on plastics, steels, cast iron, alloys or any materials that are rough on ordinary taps.

See for yourself what *Threadwell cold-tempering* (at 120° below zero) means in terms of better threads and more of them per tap, the result of increased hardness plus decreased brittleness.

Once you've had firsthand experience with the superior stamina and performance of *Threadwell Cold-Temper* Taps we won't have to urge you to standardize on them for *all* high speed tapping.

Their *uniform quality and accuracy* — Their "*i-dot-ification*" feature (*red* dot on the shank for cut thread, *white* dot for commercial ground, *blue* dot for precision ground) —

Their "*tap-capsule*" protective package, (every ground thread tap in its individual transparent plastic tube) —

Their *greaseless rust-proofing* (clean and dry to handle, always ready to use) —

All these distinctive *Threadwell* advantages plus the *personal attention* to your orders at the factory and at your *Threadwell* distributor's will speak for themselves. If you're willing to be shown, just try *Threadwell Cold-Temper* Taps.

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"TAPS OF DISTINCTION"

THREADWELL TAP AND DIE COMPANY · GREENFIELD, MASSACHUSETTS, U. S. A.

Angier
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INDUWRAP

Airplane engine and parts manufacturers were up against it for a greaseproof wrapper to prevent corrosion. Angier of Framingham produced it in INDUWRAP, which has more than met any specification ever drawn for a Grade A, Type I wrapper.

If you have a *corrosion* problem, ask for samples of INDUWRAP and for descriptive folder, "The Touch of Death to Steel." You'll be especially interested in INDUWRAP'S exclusive infused *Inhibitor* metal-contacting surface. This kills corrosion before it starts by depositing a transfer film on the exposed metal spots, often caused by breaks in the protective oil film.

Other important features are that INDUWRAP is creped to S-T-R-E-T-C-H. It lets packaged metal breathe. It is soft and pliable, molding easily to hug odd-shaped articles snugly — without rupturing. Investigate INDUWRAP.

In writing for samples and literature, please mention IRON AGE.

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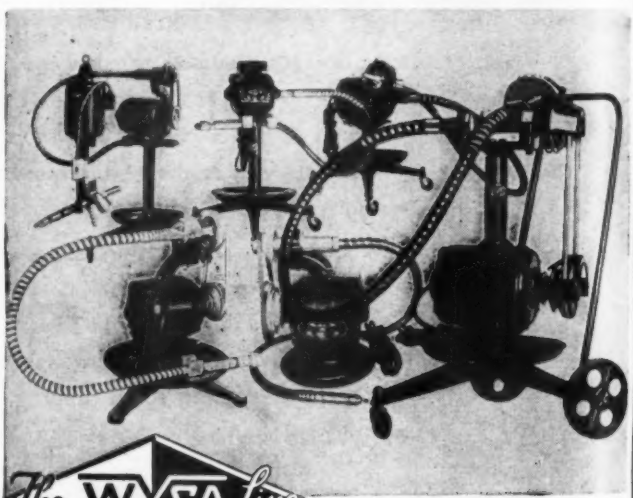
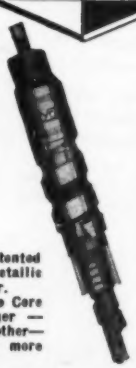


The WYCO Line

Whatever your requirement is a Flexible Shaft Machine



Wyco Patented Non - Metallic Innerliner. Makes the Core last longer — Run smoother— Transmit more power.

The Wyco Line carries a complete range of rugged, dependable units to fit any production need. The Wyco line is on the aircraft and armament front NOW, and doing a civilian production job as well — but for the post-war era — for even greater demands — the Wyco line will be geared up for 100% satisfaction in any situation where heavy, medium or light duty production is desired.

Single and Multiple Speed Floor, Bench and Suspension Models, as well as Multiple Speed Jack Shaft and Radial Type Machines, all carrying the Wyco Guarantee for materials and workmanship, are setting records for longer shaft life and greater production. Distributed through jobbers.

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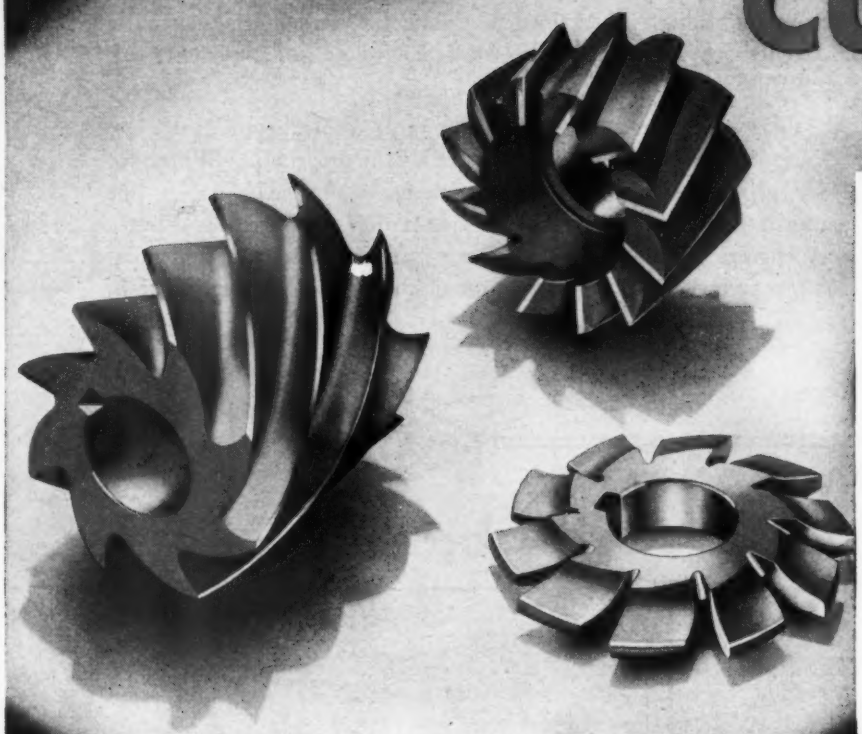
830 W. Hubbard St., Chicago 22, Ill.

Get the Most from Your MILLING CUTTERS



Remember this vital rule! In sharpening a milling cutter, maintain equal distances between all cutting edges and the axis of rotation. To prolong cutter life, inspect arbors frequently to insure they are running true.

For maximum production at minimum tool cost, specify National Milling Cutters and keep them sharpened properly.

Call Your **DISTRIBUTOR!**

Leading distributors in every section of the country have complete stocks of National Cutting Tools. Every National distributor has a factory trained man to serve you. Call your National distributor for cutting tools or any staple industrial product.

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TWIST DRILLS
REAMERS, HOBS
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SPECIAL TOOLS

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Tap and Die Division—Winter Brothers Co., Wrentham, Mass.

Factory Branches • New York • Chicago • Cleveland • San Francisco • Distributors in Principal Cities

Vitrified

Cuts longer between turns

Vitrified Grinding Wheels assure economy in high quantity production fine precision grinding because they cut longer between each wheel truing. Then, too, these long life, strong wheels require less redressing. They can also be depended on to eliminate gumming, glazing and heating.

All these advantages are available regardless of the grinding job, because there is a size, shape and type Vitrified Grinding Wheel for every grinding purpose. The completeness of the Vitrified line makes it possible for any shop to standardize on Vitrified Wheels. Our engineers will gladly study your grinding operations and point out the savings you can make through the use of Vitrified Wheels.

BORITE—for all kinds and classes of steel grinding.

CARBORITE—for all classes of cast iron, brass, bronze and aluminum grinding.

Also, Silicate, Shellac and Resinoid Bonded Wheels.

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Almond Drill Chuck

THE FIRST IN THE FIELD

ALMOND THREE-JAW DRILL CHUCKS were the first to be placed on the market over Seventy years ago. As Pioneers in the field of Drill Chucks, the name "ALMOND" has long been associated with the logical procedure of machine developments. ALMOND DRILL CHUCKS are made in types and sizes to fit all machine tools and portable drills.

Complete information is available on request.

The Original Manufacturers of Drill Chucks

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"BURROFF"

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For fast clean removal of burrs and chamfering holes (inside & outside) of multi-walled parts—where regular solid countersinks will not reach.

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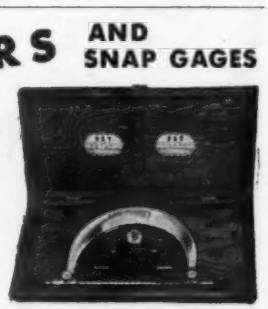
There are a variety of types available with either micrometer heads or dial indicators to cover a range of capacities from 0 to 168 in. . . *Write for Bulletin 200* or outline your gaging problems.



• D & T Bow Micrometer 0 to 6 in. capacity

Davis and Thompson Co.

Mfrs. of Machine Tools and Micrometers

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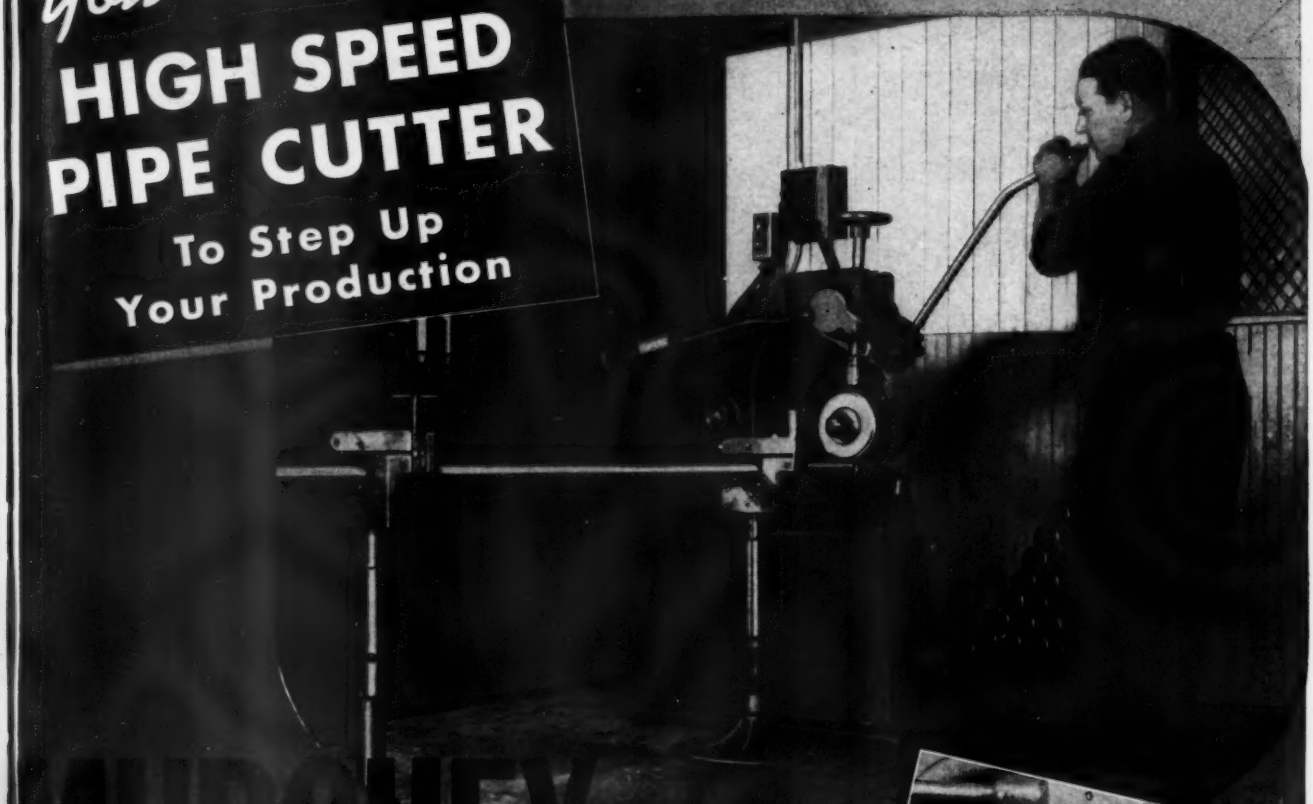
You need this

HIGH SPEED PIPE CUTTER

To Step Up Your Production

The photographs illustrate 2½" tubing—¼" wall—9" length. Speed approximately 250 pieces per hour with one man cutting and loading. This machine long in use by Standard Tube Co., Detroit, Mich.



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Model "H"

Heavy Duty Roller Pipe Cutter

The essential machine for war effort. Fits right into the war program. Unsurpassed for cutting off pipes, tubes, locomotive boiler flues. Standard cage of rollers furnished with machine may be quickly removed and replaced by either larger or smaller cage of rollers, to give machine a complete range of from ½" to 6" inclusive. Standard equipment: standard cage of rollers ½" to 4". Extra cage of rollers can be furnished for ½" to 1¼" and from 4" to 6" pipe. On gauge bar, the steel faced gauge arm can be quickly clamped to cut any desired length of pipe. This machine provides clean cutting edge ready for subsequent operation. Accurate cut, both as to length and to squareness. Write or wire for complete information.

Murchey also manufactures all types of Collapsible Taps, Self-Opening Die Heads, Thread Milling Machines, and Shell Tapping Machines. Write for literature on any or all of these products to Dept. A.

MURCHEY MACHINE & TOOL CO.
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MURCHEY

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SOLID TUNGSTEN CARBIDE COMMUTATOR SAWS!

. . . For Better, Faster, more Economical Performance

Super has done it again! Solid Tungsten Carbide Commutator Saws! Here is another result of Super Tool research and development . . . another example reflecting Super Tool's leadership in new fields and in new applications of carbide as a cutting agent.

Super Solid Tungsten Carbide Commutator Saws are available in sizes ranging from ¼" to 1" in diameter, in thicknesses from .015" up, and in hole sizes to meet specifications.

Tungsten Carbide is an ideal material for cutting the precision grooves in commutators. The use of these Super Solid Tungsten Carbide Saws results in cleaner cuts, exceptionally long cutter life and more efficient production with economies hitherto thought impossible.

Write TODAY for complete data and prices on Super Carbide Tipped Tools that every day are proving themselves MONEY SAVERS on all types of production jobs.

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- Turning, facing
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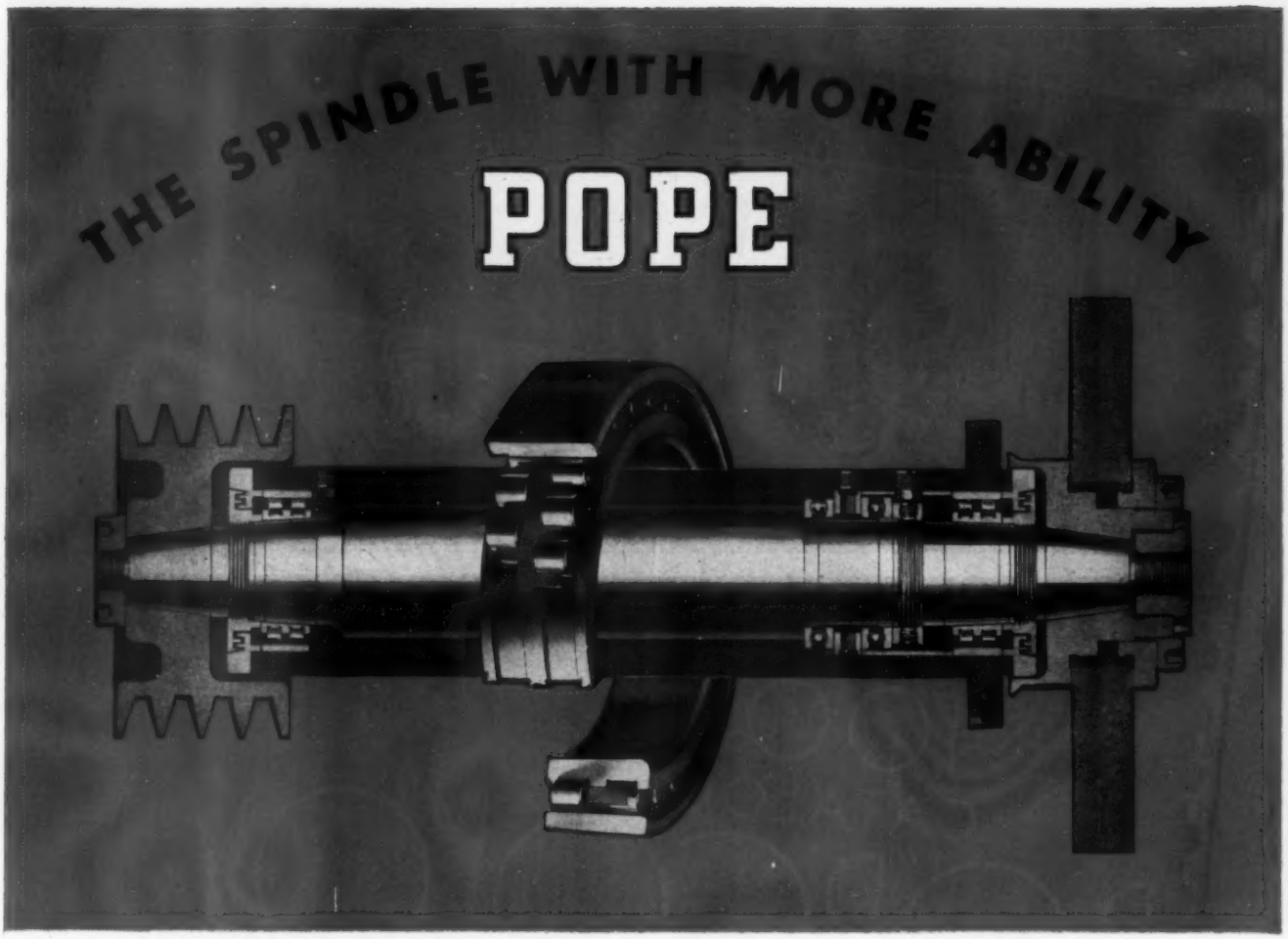

SPINDLES used for *Precision Grinding* are subject to two kinds of working loads: *Radial*, as from the wheel pressure on the work and from the belt pull, and *axial* in shoulder grinding or cup wheel grinding.

Factory experience has shown that the best performance results from the use of separate sets of bearings for the radial and thrust loads respectively. The original high quality of finish is also maintained much longer by this arrangement.

In POPE Spindles, up to 4000 R.P.M., the radial loads are carried on SKF double row roller bearings having enormous excess capacity. The great number of rollers in each bearing provides practically continuous support around the circumference of the shaft thus insuring smooth operation.

Contributing greatly to this result is the means by which each bearing is independently adjusted in assembly to provide the exact amount of *purely radial* preload required for best grinding finishes and longest life.

Thrust loads are taken on a separate pair of precision thrust bearings. These are of ample capacity and designed for accurate control of thrust and for long life.

POPE builds spindles on the principle that no spindle can be too good for precision work. Among the values built into POPE Precision Spindles are engineering by spindle specialists, workmanship by master craftsmen, plenty of the right kind of steel, plenty of selected precision bearings and POPE *Sealed Lubrication* requiring no attention for the life of the bearings.

POPE builds a wide variety of spindles for precision work.

Ask for a quotation on the spindle you need.

No. 21

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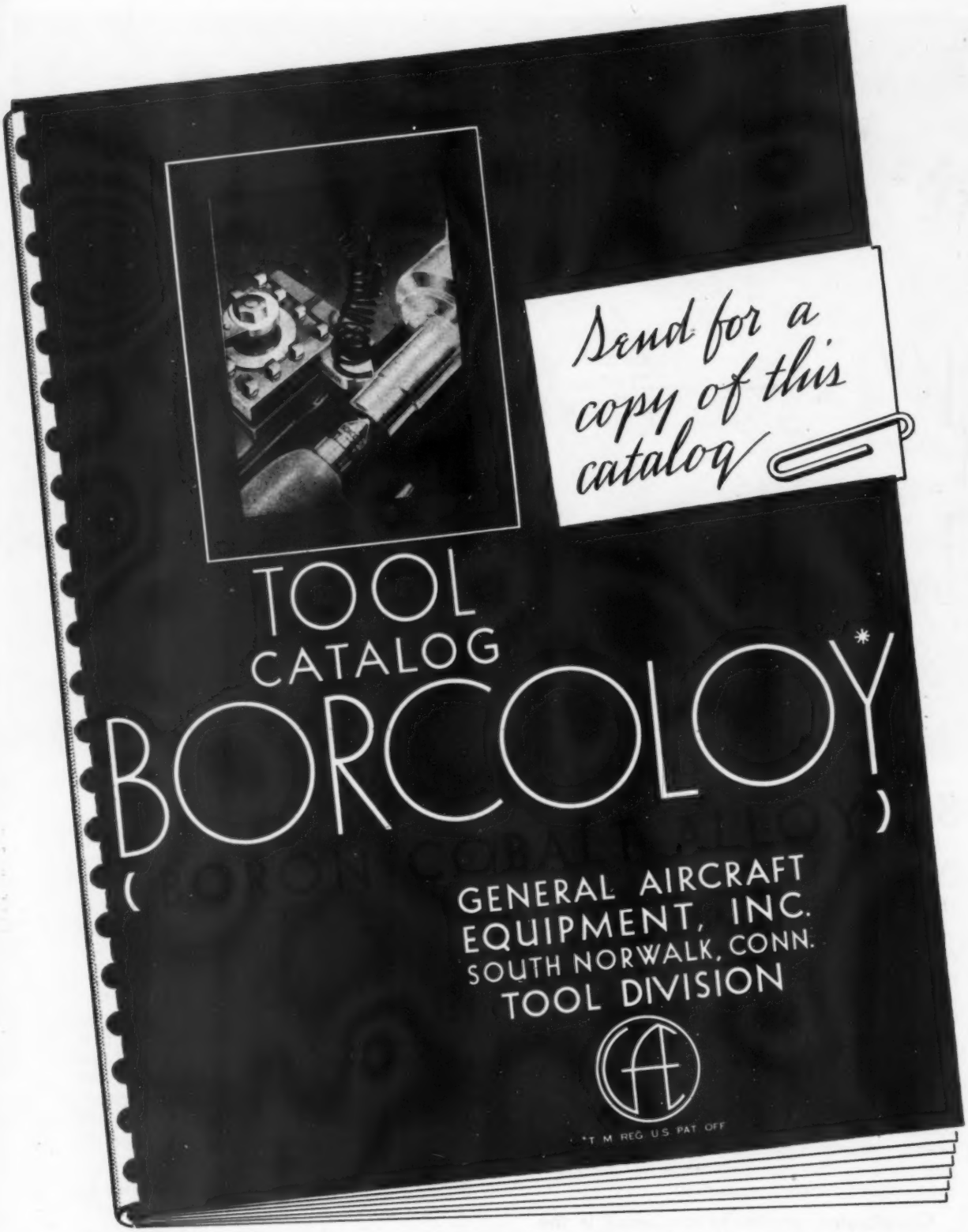
BUILDERS OF PRECISION SPINDLES



• LEARN ABOUT THIS NEW SUPER HIGH SPEED STEEL WITH ALL THE DISTINCTIVE FEATURES OF CENTRIFUGALLY CAST ALLOYS, WITH HIGH WEAR RESISTANCE DUE TO THE PRESENCE OF BORON AND WITH MAXIMUM RED HARDNESS IMPARTED BY TWENTY PER CENT COBALT •

GENERAL AIRCRAFT EQUIPMENT, INC.

SOUTH NORWALK, CONNECTICUT • TOOL DIVISION

Step Up Production with these NEW TRANSPARENT CUTTING OILS!

FOR REVOLUTIONARY cutting oil performance, you'll find it will pay you to try Socony-Vacuum's great new transparent, odorless cutting oils—the new S/V Sultrans.

Just announced, these oils already are stepping up production in many shops and are available now for your cutting operations. Their light color, transparency and odorless nature combine with outstanding lubricity and adequate anti-weld and extreme-pressure properties to give you these advantages over other oils:

Better visibility of work and *improved working conditions* for operators; *production increases* ranging from 25 to 200 per cent; *far longer tool life* and *vastly improved finish* on difficult work like this broaching job; less sensitivity to changes in hardness and structure of metals and speeds of cut, and *better drainability* for less "carry-away" and lower oil consumption.

Be sure to get performance facts and figures on these new S/V Sultrans, from your Socony-Vacuum Representative.

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1. Lubrication Study of Your Entire Plant
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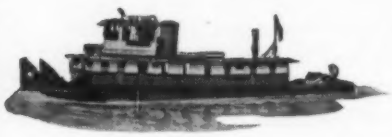
GARGOYLE Lubricants

How Engineering has Licked *HEAVY DUTY*

CLUTCH TROUBLES

If you operate heavy machinery, you know that your time losses and your maintenance expense are very likely to come from clutch trouble.

Modern engineering has come to your rescue with the Fawick Airflex Clutch, which controls power and torque by air, without arms, levers, toggles or springs.

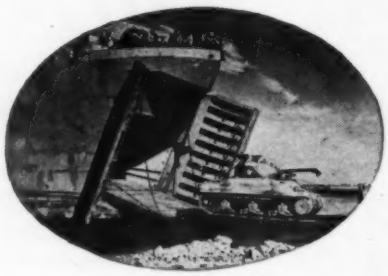


Tug goes from full speed ahead to full reverse in 3 seconds

Here is proof in the toughest kind of service. On this powerful Diesel-driven tug, the Airflex Clutch was thrown from full speed ahead to full reverse in 3 seconds, without damage to engine or propulsion mechanism. No other type of clutch could possibly absorb torque in this manner.

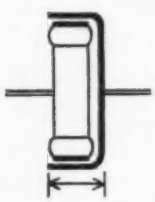
Greater maneuverability for all Naval craft

Hundreds of Diesel-driven vessels in the Navy, Coast Guard and Merchant Marine have been equipped with Airflex Clutches. Without exception, these ships have greater maneuverability. Valuable space is saved, time is saved in installation and maintenance, and in the training of personnel, and performance has new reliability, especially under combat conditions.



Landing Craft made easier to handle

The landing craft of various types that are so essential in modern warfare are being equipped with Fawick Airflex Clutches to give them more flexibility of operation, and greater dependability under extreme circumstances.



Space-saving is a definite plus

Because the Airflex Clutch has no toggles, levers or springs, it saves, through its compact design, a tremendous amount of space over other types. This is especially important on marine installations, and wherever heavy-duty drives must be put into restricted places, such as cranes, hoists and draglines.

How the Fawick Airflex Clutch Works

Inflate the rubber-and-fabric gland and it expands to engage the clutch. Deflate and the clutch is disengaged. As simple as that is the way the Fawick Airflex Clutch controls power by air, without springs or levers or toggles.

Suitable for many important industrial applications

The Fawick Airflex Clutch has proved its efficiency and economy on steel mills, rubber mills, paper mills, hoists, shovels, cranes, draglines, dredges, presses, punches—all types of heavy duty machinery. Acts as clutch, brake, slip-clutch, flexible coupling or power take-off.

Engineering service

The Fawick Engineering Department will gladly consult with you on clutches for all kinds of heavy duty drives. Booklet on request.

• • •

FAWICK AIRFLEX COMPANY, INC.

9919 Clinton Rd. • Cleveland 11, O.

In Canada, Ronald-Coventry Ltd., Montreal, Toronto, Vancouver

In Britain, Crofts Engineers, Ltd., Bradford, England

FAWICK *Airflex* CLUTCH

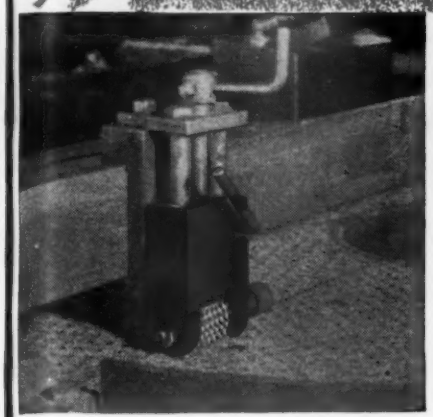
POWER CONTROLLED BY AIR

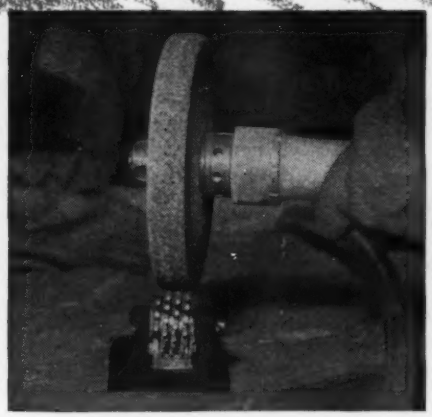
SPI-RAL

EMERY WHEEL DRESSERS

Perfect Conditioned Grinding Wheels at Much Lower Costs···

"LIKE A RARE JEWEL IN A CLASS ALL ITS OWN" CANNOT BE OUTPERFORMED



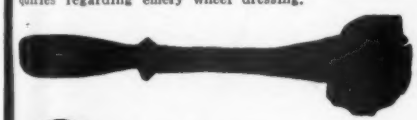


SPECIAL HOLDERS

Special applications for the SPI-RAL cutter are numerous. Pictured above is just one of the many special holders being built for special dressing operations. The above is a 54" disk wheel being dressed with one No. 410 SPI-RAL cutter. We welcome any inquiries regarding emery wheel dressing.

The D-310 SPI-RAL dresser being used to dress and recondition the emery wheel of an air operated hand grinder. The D-310 SPI-RAL dresser is fastened to the bench and the operator, with very little effort moves the running emery wheel over the SPI-RAL dresser and in a few seconds reconditions the grinding wheel.

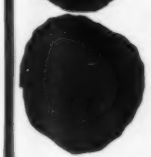
The SPI-RAL dresser is never tilted when applied against the emery wheel, but is held as shown in the picture above. A sure grip, an even pressure, held straight against the wheel, "no tilting" and a slow movement from side to side will result in a true and well dressed emery wheel, free of foreign matter, grooves and ruts.



No. 10 SPI-RAL DRESSER

For tool grinders and wheels that require a very fine finish.
No. 10 Dresser Complete.....$2.50
No. 110 Cutter Only..... .75

No. 21 SPI-RAL DRESSER



For medium or soft grain wheels where a smooth surface is desired.
No. 21 Dresser Complete.....$2.55
No. 210 Cutter Only..... .80

No. 31 SPI-RAL DRESSER

For fast dressing of coarse wheels. For foundry or any other snagging operations.
No. 31 Dresser Complete.....$2.60
No. 310 Cutter Only..... .85
Nos. 110, 210 and 310 cutters are interchangeable in the same handle.
Cutters are 1¾" diameter by 1 1/16" long.

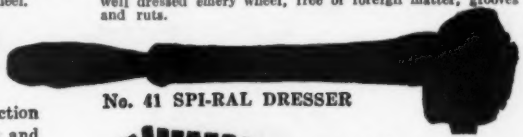
PROPER APPLICATION OF THE SPI-RAL DRESSER

The principle of design and construction of the SPI-RAL cutter is basically new and is covered by patent rights. The cutter is made in a single piece spiral, in various sizes, which, when employed in the dressing operation of an emery wheel, cuts across the face of the wheel evenly, rather than bumping off the grain. The result is a truer dressed wheel with not only an economy effected in the life of the emery wheel, but in the longer life of the dressing cutter itself.

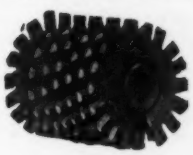
The cutter revolves on a bushing which in turn revolves on the shaft, giving it a double bearing and reducing friction to a minimum.

All moving parts are properly hardened and are provided with oiling facilities.

The hooded handle protects the operator from flying abrasives.



No. 41 SPI-RAL DRESSER

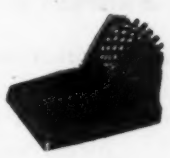


For wheels 2½" wide or wider. For foundry and coarse grinding operations. Rugged construction for heavy duty service.
No. 41 Dresser Complete $3.50
No. 410 Cutter Only..... 1.25

No. 42 SPI-RAL DRESSER

For wheels 2½" wide or wider where a smooth finish and fast cutting action is desired.
No. 42 Dresser Complete $3.50
No. 420 Cutter Only..... 1.25
Nos. 410 and 420 cutters are 1⅜" by 2¼" long. Interchangeable in No. 41 handle.

No. D HOLDERS FOR DISC GRINDER



Nos. 110, 210 and 310 cutters interchangeable in No. D holder. Unless specified, No. 310 cutter is furnished.
No. D-310.....$2.85

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STANDARD TOOL & GAGE CORP.

Precision Built Tools and Gages

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WEST ALLIS, WISCONSIN

Standard Tool & Gage Corp.
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Gentlemen: Please send me additional information on Spiral Dressers

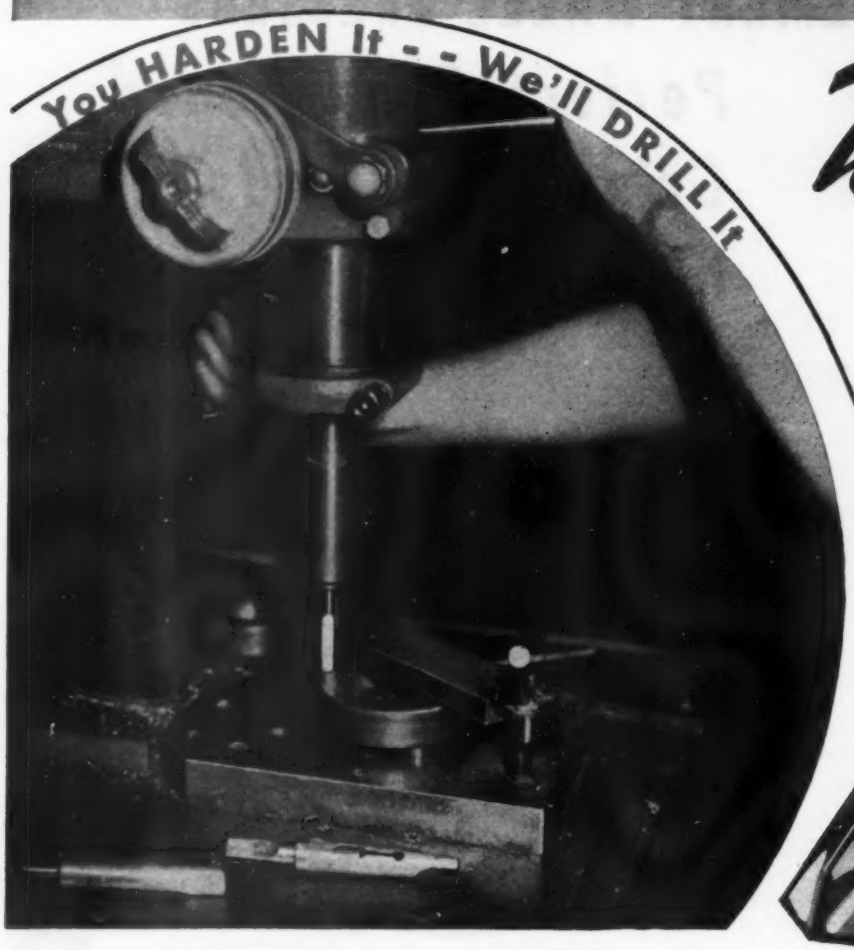
Name .....

Company .....

Address .....

City .....

"HARDSTEEL"



Drills

SPOT and DRILL

Fifty Hardened Steel Rings Per Hour

A well known manufacturer in Detroit faced the task of drilling 1 9/64" holes in a production run of four-inch steel rings —hardened to 65 Rockwell "C" and carburized on one side to a depth of 3/16".

Two "HARDSTEEL" drills were used— 7/16" for spotting and 1 9/64" for finishing —in an ordinary drill press running at 2300 R. P. M. The pieces were spotted and drilled without the slightest trouble or delay at the rate of fifty per hour.

"HARDSTEEL" drills in thousands of metal working plants are drilling steels hardened by any process—even work hardening steels. You need them in your plant—have them available and save money on both production and parts recovery operations.

LEARN TO DRILL HARDENED STEELS WITHOUT ANNEALING

The "HARDSTEEL" Operators Manual is free. Write for copy.

Also inquire about "HARDSTEEL" as a metal. Many manufacturers are finding it ideal for special parts that must meet unusual conditions of service.

"HARDSTEEL"

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NEW

MECHANICAL SIMPLICITY

MAXIMUM SAFETY

ADAPTABILITY

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THE WOODWORTH "CONE-LOK" JIG

The N. A. Woodworth Co. gives to industry a *new adjustable clamping jig* that possesses features that will increase *production* and reduce *production costs.* The new Woodworth "CONE-LOK" Jig utilizes the great braking power of perfectly mated male and female cones which assures instant locking effect so that the tray is positively clamped at any location whenever pressure in either direction is applied to the tray.

The Woodworth "CONE-LOK" Jig has only three actuating parts, is of rugged construction, and operates in an oil bath which promotes long service life.

The Woodworth "CONE-LOK" Jig is *safe, secure,* and *sure.*

N. A. Woodworth Co.
1300 E. 9 Mile Rd., Detroit 20, Michigan
Gentlemen: Forward my copy of the "Cone-Lok" Jig Catalog No. 45-J.

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PRECISION GAGES • PRECISION MACHINED PARTS • PRECISION TOOLS

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Stand the gaff of toughest threading demands . . . . . .

CARD DIES ARE AVAILABLE THROUGH LEADING DEALERS

Under today's conditions, when quality must be maintained regardless of quantity demands, it is good to know that CARD DIES can be depended on for production threading.

The CARD line includes Spring Screw Threading Dies of carbon steel in machine screw and fractional sizes, Adjustable Round Split Dies for both hand and screw machine work in machine screw, fractional, and pipe sizes.

In addition CARD manufactures Hexagon Rethreading Dies, Solid Square Pipe Dies and Bolt Dies.

Consult the Card Catalog for your requirements. Send for your copy today.

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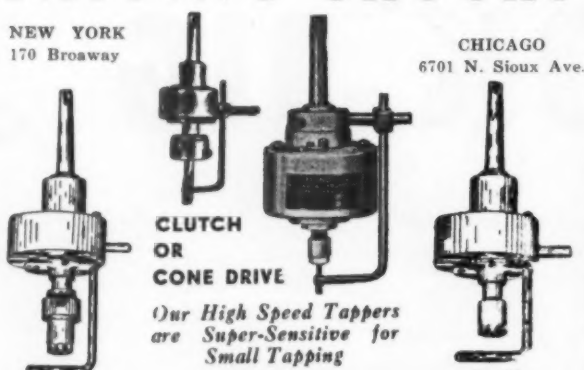


CLUTCH OR CONE DRIVE

Our High Speed Tappers are Super-Sensitive for Small Tapping

Friction
No. O O C. S.

Positive
No. O O H. S.

Style B Positive Stop Holds Work Down

Style C Graduated Adjustable Safety Friction

DRILL PRESS TURRET

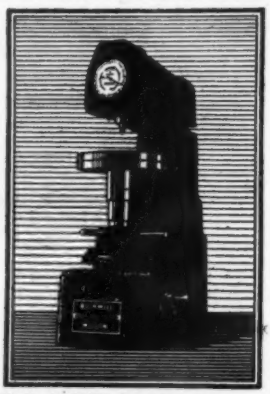
Style D-E with Quick-Change Tool Holders to Drill, Tap and Set studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustment in each tap-holder. If required.

Also, Opening Die-Heads; Opening Stud-Setters; Friction Screw-Drivers and Nut-Setters, etc.

"ROCKWELL" HARDNESS TESTER

These new improved type testers available from stock in all sizes.

The word ROCKWELL has been our Trade Mark for 24 years and is the mark that insures precision.



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MECHANICAL INSTRUMENT CO., INC.
357 Concord Ave., New York 54
An Associate Company of American Chain & Cable Company, Inc.

H. & H. SURFACE PLATES & ANGLE IRONS

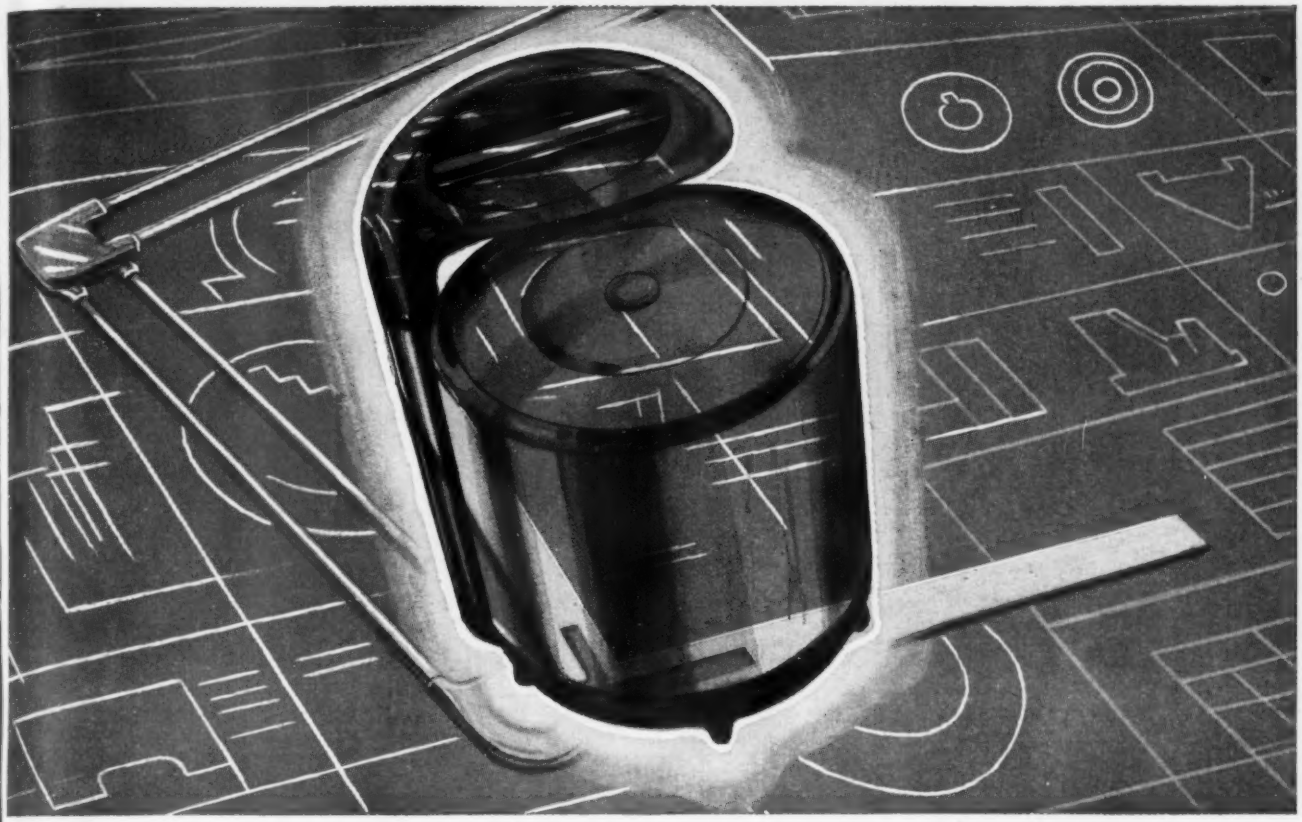
available in a wide range of sizes

Write for list of sizes and details.

Surface Plates and Inside and Outside Angle Irons normalized, first grade gray iron, nickel iron, or meeninite castings. Can be furnished finished, machined, hand-scraped or ground.

H. & H. MACHINE TOOL CO., Waltham, Mass.

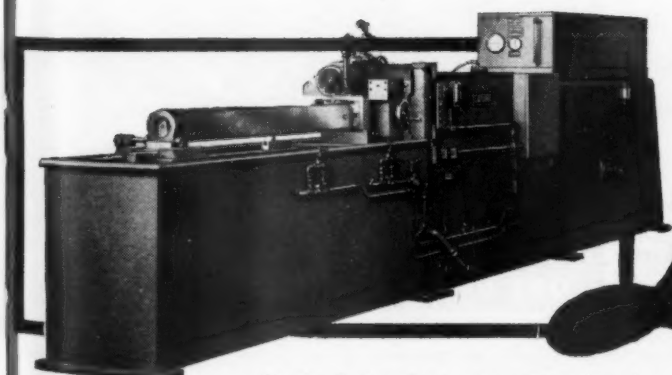
• IF YOU PLAN FOR TOMORROW...CONSULT LAPOINTE TODAY •



PRODUCTION PERFECTED!

Speedy, economical production of precision parts for today's and tomorrow's better products are now being planned by the Lapointe Engineering Staff. For example — a leading maker of washing machines will require a five-fold production increase after peacetime re-conversion. Consulting with Lapointe engineers, he learned that twenty-five parts of his postwar product could be broached. After V-Day, his desired output can be obtained . . . better precision assured.

If you plan for tomorrow . . . consult Lapointe today. Likely, Lapointe broaching experts will be able to point out important savings in time and money in the making of the product you plan to place on tomorrow's competitive market.

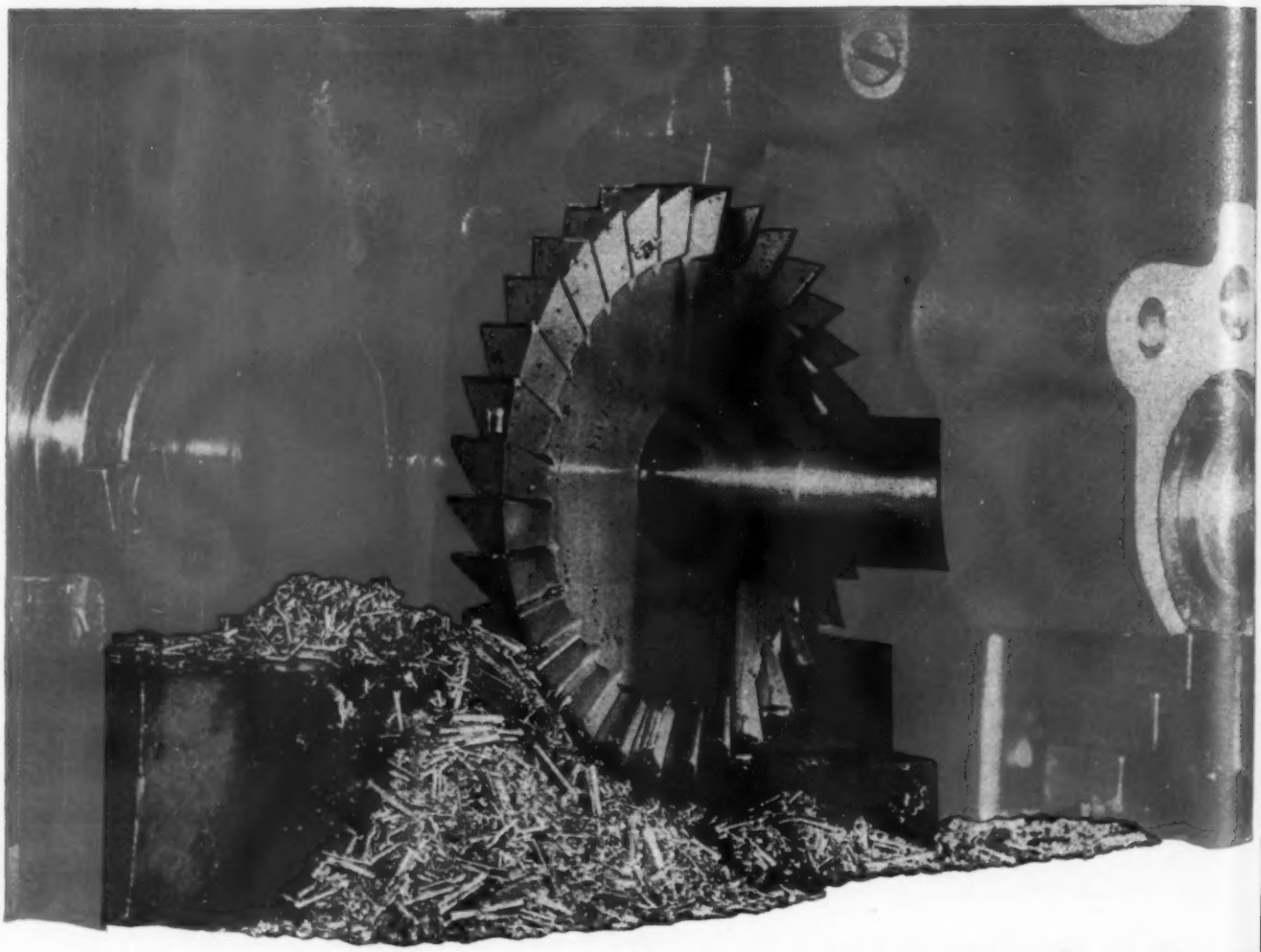


On the factory front where the order of the day is war production, Lapointe machines are producing critically-needed equipment. A precision part of a tank-sighting device is speedily made by the Lapointe machine above. Victory-essential broaches and broaching machines have top priority at Lapointe.

THE Lapointe MACHINE TOOL COMPANY

HUDSON • MASSACHUSETTS • U. S. A.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES



WHEN THE CHIPS ARE DOWN –

—you see why Morse tools are such dependable cost-reducers

When the chips are down . . . that's when you get proof that the teeth of Morse Cutters have proper clearance and are accurately ground. That's also when you begin to see what Morse precision manufacturing adds up to: less spoilage, less down-time for expensive machine tools, lowered costs. Use Morse Tools yourself!

MORSE THERE *IS* A DIFFERENCE **TWIST DRILL AND MACHINE COMPANY**
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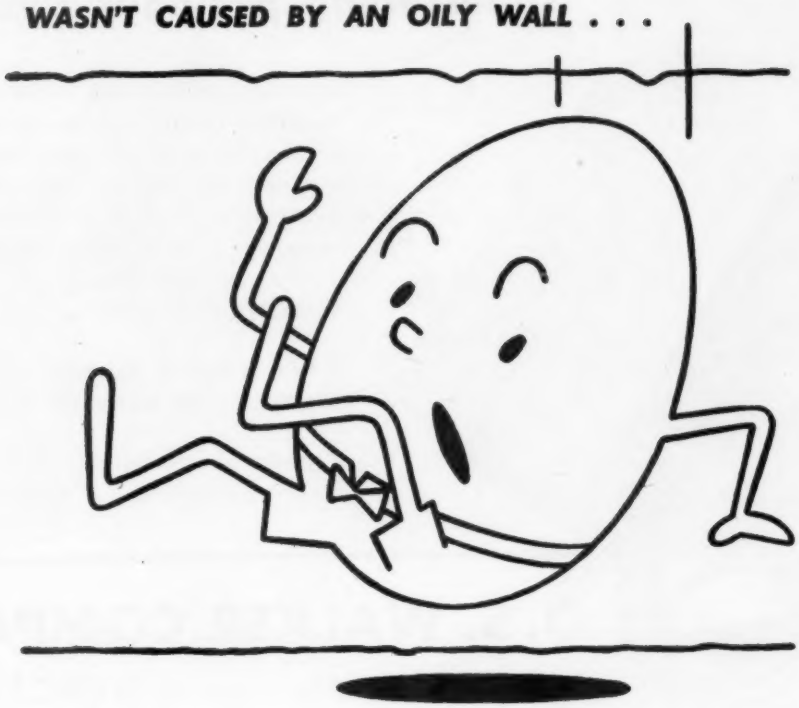
FAMOUS FALLS No. 1

HUMPTY-DUMPTY'S FAMOUS FALL

WASN'T CAUSED BY AN OILY WALL . . .



BUT many a serious fall in industry *is* caused by oil on the floors. It's SPEEDI-DRI's business to stop those falls — and SPEEDI-DRI knows its business better than anything else ever devised for the purpose.

You simply spread this white, granular, skid-proof material on the floor and *immediately* it begins to soak up oil and grease like a blotter absorbs ink. No need for expensive cleaning machines, dangerous solvents and caustics, or excessive porter-labor. Just sweep it up (without interrupting production) and your floor will be clean and dry.

Thousands of war-busy plants are using SPEEDI-DRI to step-up production by making workers more sure-footed, to improve labor relations, to save money on cleaning costs, to reduce accident rates. Leading insurance companies recommend it. It will not readily burn even when oil-soaked. Isn't it about time you looked into the possibilities of this product for *your* plant? Write today for generous, free sample.

SUPPLIERS: East — Refiners Lubricating Co., New York 1, New York.
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SPEEDI-DRI
OIL AND GREASE ABSORBENT

WALKER *does it again!*

with a brand NEW BAR POLE CHUCK superseding previous design

Leadership of WALKER in the field of electric chucks is again evident. . . . The recent development of the Longitudinal Bar Pole Chuck and its enthusiastic reception because of its successful test, indicated that the same improvement could be incorporated in the transverse type of fine division Bar Pole Chuck—Here it is. . . . *Abuse* and *Waterproof*. Ready to carry the WALKER guarantee for splendid service.

A new feature in Bar Poles. . . . Both Transverse and Longitudinal top plates are replaceable!

Available in sizes from 6" x 10" to 12" x 60", also for special applications. Get in touch with your dealer.

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JUST 20 SECONDS

FOR SMALL DRILLS FROM No. 70 TO 15/64"

Tombill Drill Sharpener is speedy and economical. An inexperienced operator can grind exactly the right degree on drills from No. 70 to 15/64". Write for folder.

MERCURY PRODUCTS CO.
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LUERS Patented Cutting Off Tool Holders
Patented Cutting Off Blades

ONLY the PATENTED construction of LUERS cutting off BLADES permits normal expansion of bursting chips — MEANS MAXIMUM CUTTING EFFICIENCY.

Manufactured By
J. Milton Luers — 12 Pine St. — Mt. Clemens, Mich.
Produced under License Issued by John Milton Luers Patents Inc.

Famous for

- ACCURACY OF THREADS
- LOW CHASER COST
- ALL AROUND DEPENDABILITY

Bulletins available: General Purpose Die Heads, Insert Chaser Die Head, Threading Machines.

See our Advt. on page 388 Nov. 23, '44, American Machinist

THE EASTERN MACHINE SCREW CORP., 20-40 Barclay St., New Haven, Conn.
Los Angeles: A. C. Behringer, 324 N. San Pedro St., San Francisco: Guy Reynolds, 684 Vernon St., Oakland, Canada: F. Barber Machinery Co., Toronto, Canada.

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All Perkins Swivel Vises swing 360 degrees and have complete circle graduations. All Angle Vises raise 92 degrees.

Write for Bulletin No. 110

MILLER-KNUTH MFG. CO. OMAHA, NEB.

● Speed up your milling operations today—with machines that will be *right* for your needs tomorrow! Call on Kent-Owens for the practical features you'll want in investing for *permanent* business.

Shop men everywhere appreciate the outstanding *dependability, economy* and *flexibility* of these machines . . . adaptable to a wide range of work. Rugged . . . simple . . . efficient. Write for latest bulletins. Kent-Owens Machine Co., Toledo, Ohio.

THERE'S A KENT-OWENS REPRESENTATIVE NEAR YOU

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General Machinery Corp.

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Call on **KENT-OWENS** *for Milling Machines*

No. 1-14 . . . 32" x 9" table . . . 14" table travel . . . hydraulic table feed . . . full automatic cycle.

Deliveries within 2 Weeks

THESE 81 JO-BLOCKS

—make 120,000 of the most accurate* Tools in the World!

(at a cost of about 2⅓ mills per tool)

There is nothing fanciful about these figures . . . they're as indisputable as the accuracy of Johansson Gage Blocks themselves. With the popular No. 1 Set of 81 blocks, as illustrated, any one of 120,000 different size gages may be made up (in a few moments), in steps of .0001", from minimum size .200" to more than 12 inches.

On a strict cost basis, it is not only thoroughly practical, but highly advisable to extend the benefits of Jo-Block precision well beyond your master-gage department and your tool-room, to include inspection of close-limits production as well. This is particularly true of those limited-quantity jobs which might be described as "custom-production", for which permanent gaging could easily cost more than the job itself. The cost of replacing any blocks that might be thus unduly worn would be negligible by comparison.

Anyone who must measure precisely and easily and quickly, can *and will* do a better job if he has ready access to a set of Jo-Blocks. Jo-Blocks are *not* "too good for the job"—*no tool* is too good for the job, if it accomplishes it better and for less money. Write for Catalog 16 to FORD MOTOR COMPANY, Johansson Division, Dept. AM, Dearborn, Michigan.

***Currently manufactured to accuracy standards of ± .000004 and .000008 of an inch.**

BLOCK SETS:

Set No. 2—35 blocks, making 80,000 gages in steps of .0001" from .300" to more than 8 inches. *Set No. 3*—36 blocks, making 80,000 gages in steps of .00005" from .150" to more than 4.250". *Set No. 4*—28 blocks, making gages in steps of .00005" from .060" and in steps of .0001" from .040" to more than .375". *Set No. 10*—8 blocks making 74 gages in steps of one inch from 10" to 84". *Set No. 15*—7 blocks, making 127 gages in steps of .03125" from .03125 to 3.96875". *Set No. 16*—5 blocks, making 31 gages in steps of .0625" from .0625" to 1.9375". *Set No. 18*—9 blocks, .1001" to .1009", inclusive, by ten-thousandths. *Set No. 19*—11 blocks, .10000" to .10010", inclusive, by hundred-thousandths. *Set No. 20*—9 blocks, .0501" to .0509", inclusive, by ten-thousandths. *Set No. 21*—9 blocks, .0201" to .0209", inclusive, by ten-thousandths. *Set No. 22*—10 blocks, .010" to .100", inclusive, by hundredths.

ACCESSORIES:

Jaws, adjustable holders, triangular straight-edges, foot blocks, sine bars, center points, 60° center points, scribers, and tram points.

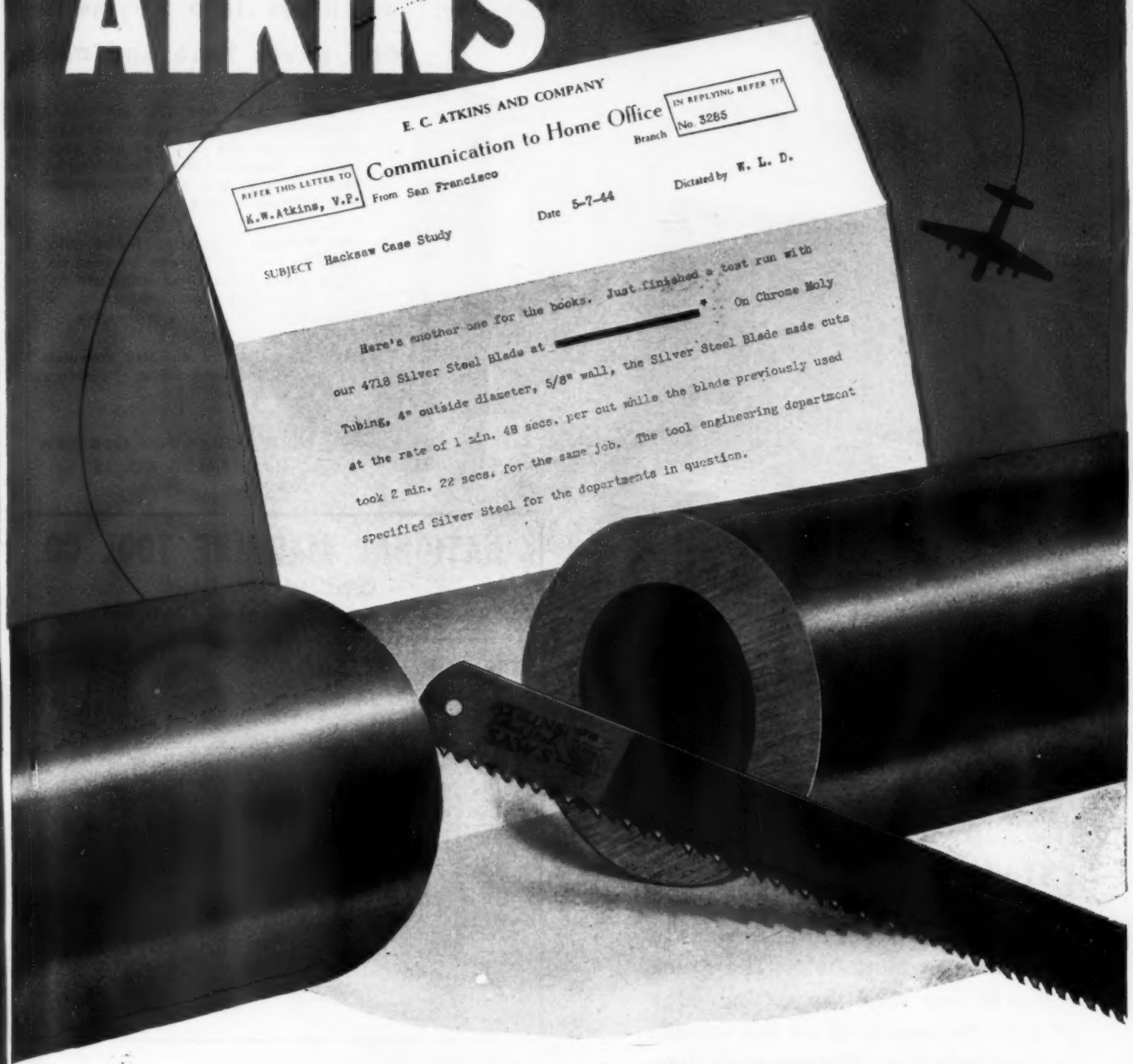
The usefulness of your Johansson Gage Blocks is increased more than 300 per cent by these accurate Accessories, which permit measurements of Height, Length, Depth and Angle.

Ford

Johansson

GAGE BLOCKS

ATKINS Cut Costs by Cutting Time


E. C. ATKINS AND COMPANY
Communication to Home Office
IN REPLYING REFER TO
No. 3285
Branch
REFER THIS LETTER TO
K.W. Atkins, V.P.
From San Francisco
Date 5-7-44
Dictated by W. L. D.
SUBJECT Hacksaw Case Study
Here's another one for the books. Just finished a test run with
our 4718 Silver Steel Blade at [redacted]*. On Chrome Moly
Tubing, 4" outside diameter, 5/8" wall, the Silver Steel Blade made cuts
at the rate of 1 min. 48 secs. per cut while the blade previously used
took 2 min. 22 secs. for the same job. The tool engineering department
specified Silver Steel for the departments in question.

During these war production years, the emphasis has been on production — getting out "enough and on time." With men's lives at stake, costs were secondary. But now industry realizes that many of the same tools used to increase output point the way to substantially lower costs as well.

Atkins Silver Steel Blades are a case in point. By permitting faster cutting rates, they reduce the cutting cost per unit. By making more cuts per blade, they reduce tool costs as well as the unproductive time spent in tool change-overs. Further proof of these points — and a job demonstration are available on request.

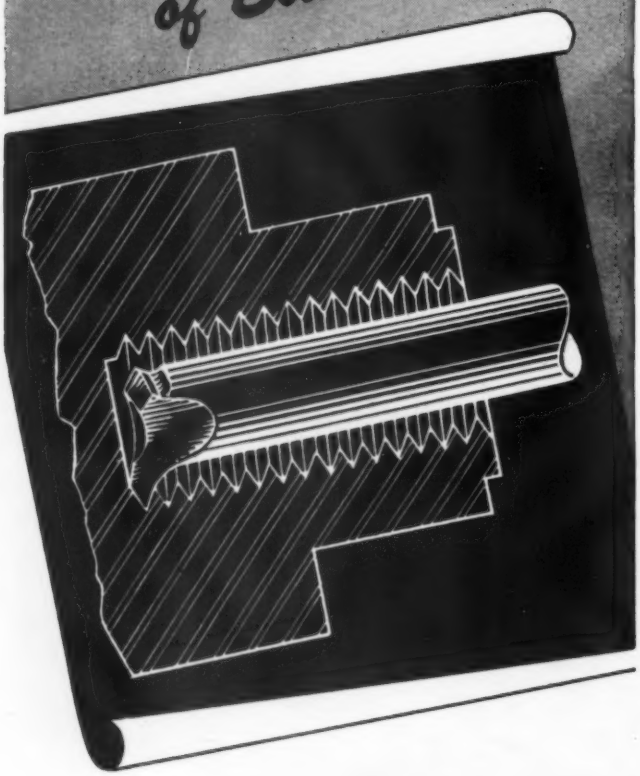
*Prominent western aircraft manufacturer. Atkins Metal Cutting Saws have won notable distinction throughout this great industry.

E. C. ATKINS AND COMPANY
South Illinois Street, Indianapolis 9, Indiana
424 Agents or Dealers in Principal Cities the World Over

ENGINEERED SAWS FOR EVERY METAL CUTTING JOB

HOW TO MAKE PERFECT THREADS

To the Bottom of Blind Holes



BY USING a Bokum single point (Style C), internal threading tool, you can produce threads clear to the bottom of blind holes. The shank being in line with the cutting edge of tool, the angles of all the threads are perfectly true. Sharpening is done on only one face without disturbing or changing the angle. No other tool like it.

Bokum tools of the same type are also available for general boring (Style A), and for bottoming and facing (Style B).

For super High Speed Tools, ask for Catalog K-1139 and for Carbide Tipped K-398

BOKUM TOOL CO.
14775 WILDEMERE AVE. · DETROIT 21, MICH.

NATIONAL KEYSEATING MILLER

. . . the tool that converts drilling machines into key-seaters and saves time and money

• With this modern tool you can handle keyseating jobs not suitable for keyseating machines on any of your drill presses or radials. Keyseats with parallel sides, accurate in depth and in perfect alignment with bore axis are assured.

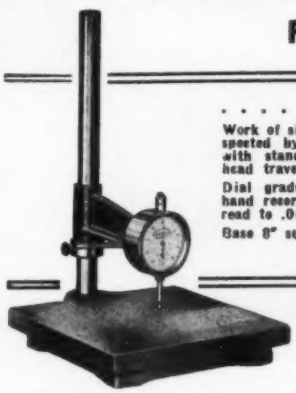
The National Keyseating Miller mills, keyseats in one cut. It can be used on taper holes, offset holes, blind holes and for taper keys. Work clamping is unnecessary. We also manufacture oil-grooving millers.

Made in twenty-six different diameters from ½" to 3½". Several widths of cutters can be used in each size.

WRITE TODAY FOR OUR NEW CATALOG NO. 15

NATIONAL MACHINE TOOL CO.
CINCINNATI, OHIO

The RANDALL & STICKNEY Platform Gauge



. . . . takes work up to 7 inches

Work of similar size can be quickly and easily inspected by setting gauge head at desired height with standard block or plug. Spindle on gauge head travels ½".

Dial graduated 0 to 50 in thousandths; second-hand records 10ths of inches. Can be furnished to read to .01 mm.

Base 8" square; height 13"; weight 18½ lbs.

Investigate Now!

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Waltham 54, Mass.

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Consistent Quality

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at Kenmore Sq. BOSTON
DETROIT · CHICAGO

"Elementary, my dear Watson!"

To detect and arrest the cause of a shortage or delay in machine-production of war materiel, the first elementary step toward solving the mystery is this question: "Where did the work-schedule fall down?"

And where war-production machines are equipped with Veeder-Root Counting Devices, the mystery can be solved then and there. For a checkup of the counter-figures on all machines will show right where the trouble occurred. Even more than that, Veeder-Root Devices make it possible to police a plant *against* such production upsets. Because a regular check of the counter-figures will show when a machine *begins* to fall behind schedule, so that mechanical or power adjustments can be made *before* trouble really takes hold.

This is what's known as Veeder-Root COUNTrol. And it would be a quick and easy matter to cover *your* war-production with it completely, right now.

The Counting House *of Industry*

VEEDER-ROOT INC.

Hartford 2, Connecticut

In Canada: Veeder-Root of Canada, Ltd., Montreal
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★ The Armed Forces Count on *You* to BUY BONDS! ★

Simplifying THE BORING OF IRREGULAR WORK *with the* HARTFORD V-BLOCK FIXTURE

The outstanding convenience of the Hartford V-Block Fixture as a means of handling difficult set ups of irregular work is illustrated here. The time required for setting up by this modern method is vastly less than that required by make-shift methods. Furthermore work is handled to much closer limits.

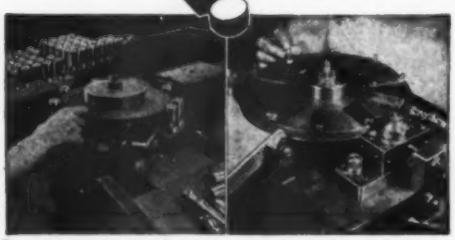
The design of this Fixture and the holding accessories which are included in its equipment are such as to make it highly useful in many ways. It is particularly applicable to set ups for boring, drilling, milling and reaming operations. It is also widely used for inspection, its accurately machined and scraped base making it adaptable for precise mounting on surface plates.

The Hartford V-Block Fixture will more than pay its way in any shop. Investigate TODAY.

The HARTFORD SPECIAL MACHINERY CO.
HARTFORD 5, CONN.

MARKING

FUSE PARTS TODAY ? SLIDE FASTENERS TOMORROW



POSTWAR PLANNING can begin with the tools you purchase today. In the field of marking Noblewest equipment is designed to give you 1) the finest precision marking at speeds critical war production demands; 2) greatest possible adaptability in retooling for competition in post-war markets. Write for catalog supplement No. 43 — Your Guide To Faster, Better Marking.

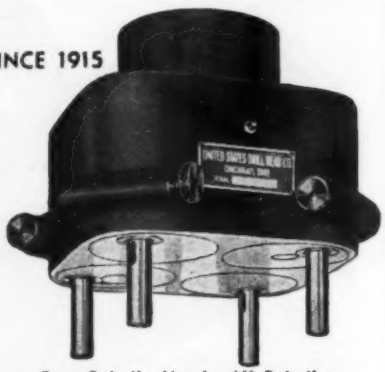
NOBLE & WESTBROOK MANUFACTURING CO.
WESTBROOK ST., EAST HARTFORD, CONN.

MARK IT BEST WITH NOBLEWEST® NOBLEWEST IMPROVED MARKING DEVICES

STANDARD US HEADS SINCE 1915

All Types of Fixed Center

DRILLING TAPPING & BORING HEADS



Four Spindle Head. All Spindles Adjustable for equally spaced holes.

FIVE TYPES, 56 SIZES, ADJUSTABLE DRILL HEADS

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HARDNESS TESTER

Let the SCLEROSCOPE speed up the production of that s so we can blow the Axis to HELL

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TELEPHONE: JAMAICA 6-4090

Dotted outline shows hub before upsetting

Aluminum Propeller Output INCREASED 55% with TOCCO Induction Heating

A LARGE manufacturer of automotive and aircraft parts reports these improvements in the heating for upsetting of aluminum propeller hub flanges for many of our fighters and bombers, including the B-29 Superfortress:

The former batch heating method—hot, dirty, cumbersome and non-uniform—required 2½ hours to heat the hubs. Total output averaged 45 per hour.

The 5-station TOCCO Induction Heating machine shown above—compact, clean, cool and accurate—heats 9″ of the 5¼″ diameter hubs to 800-850° F. uniformly throughout both length and cross-section. Every 47½ seconds, a prop is ready for the upsetter which is shown at the left of the TOCCO machine. Output of this one TOCCO unit averages 70 per hour . . . 55% faster than former method.

Find out how TOCCO can speed up your war production . . . improve your products and working conditions . . . cut your postwar costs. Write for free copy of "Results with TOCCO".

THE OHIO CRANKSHAFT COMPANY • Cleveland 1, Ohio

TOCCO

INDUCTION

HARDENING . . BRAZING

ANNEALING . . HEATING

"WHERE'VE WE BEEN ALL THIS TIME, JIM?"

That's the eloquent report of these two dyed-in-the-wool operators of set-up wheels after they had thoroughly tried out the abrasive *belt* idea.

In place of the old time set-up wheel, a modern, resilient contact wheel was applied on the lathe.

From this a Metalite Cloth belt, built for this very purpose, was led to the pulley of the Idler Backstand, the lathe started up and these long-experienced mechanics achieved the following results *on one belt:*

Removal of welds from forty (40) metal kit boxes 18″ x 12″ x 12″.

Finished surface on twelve hundred (1200) metal handles for grease guns.

This same work formerly required *eighteen* (18) *set-ups.*

Nine to one in favor of the Idler Backstand belt method, faster work and finer surfaces!

Any of our Field Engineers will be glad to discuss with you the various makes of such equipment as well as the type of abrasive belts for your specific jobs. Just a line to our nearest branch or to our home office. Behr-Manning, Troy, N. Y.

Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Grand Rapids, High Point, Indianapolis, Los Angeles, New York, Philadelphia, St. Louis, San Francisco, Tacoma.

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(DIVISION OF NORTON COMPANY)

Reliable Coated Abrasives Since 1872

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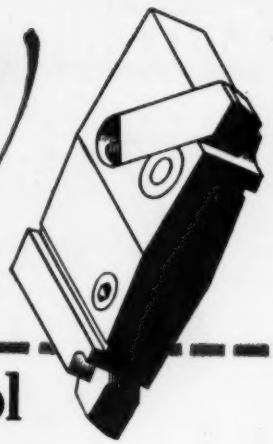


Block Type Boring Tool

This quick detachable cutter block provides self-centering, positive locking, quick inserting of block in boring bar and easy removal, without the aid of locating holes or screws, keys, wedges or taper pins.

The block containing the fully adjustable blades is simplicity itself. Made to engage both sides of the precision ground flats on the bar it quickly and accurately centers itself. When located, the cutting thrust pressure is evenly distributed against the back and bottom of the slot.

This new tool combines quick change, positive drive and accuracy. Greater rigidity is assured because the bar is free from centralizing screw holes.

HOW IT WORKS: To Insert Block slip block through the slot in the bar until the projecting lugs engage the ground flats on the bar. It is then perfectly centered. Snap in spring clips which hold the block in place and effectively seal the unit from dirt, chips, etc.

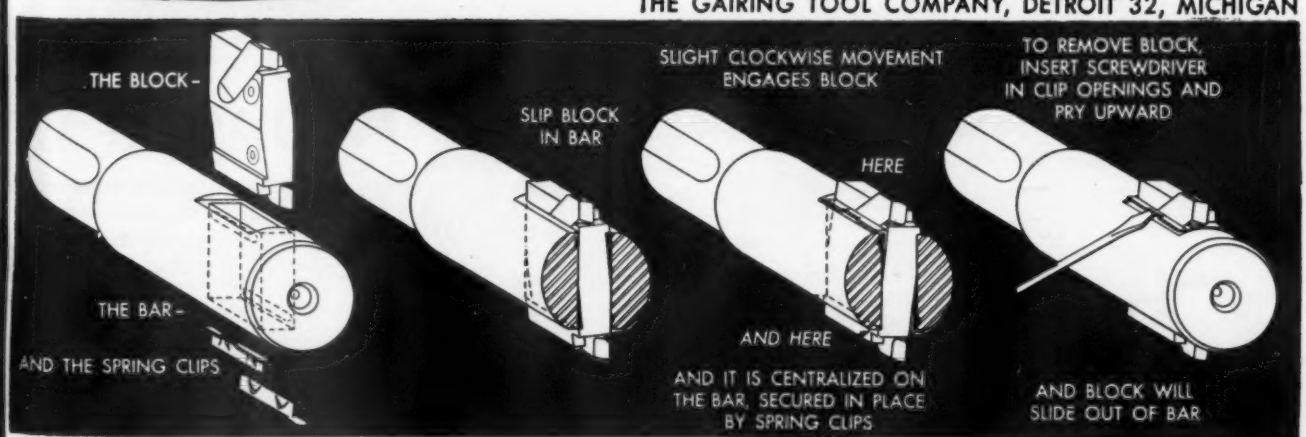
To Remove Block flip out clips, disengage the contact surfaces and withdraw the block.

Blocks can be reversed in bars for inverted operations.

Write for our illustrated folder describing these tools in detail.

GAIRING

THE GAIRING TOOL COMPANY, DETROIT 32, MICHIGAN


THE BLOCK -
THE BAR -
AND THE SPRING CLIPS
SLIP BLOCK IN BAR
SLIGHT CLOCKWISE MOVEMENT ENGAGES BLOCK
HERE
AND HERE
AND IT IS CENTRALIZED ON THE BAR, SECURED IN PLACE BY SPRING CLIPS
TO REMOVE BLOCK, INSERT SCREWDRIVER IN CLIP OPENINGS AND PRY UPWARD
AND BLOCK WILL SLIDE OUT OF BAR

CRITERION *Boring Heads*

TOOLS of *Quality* for *Quantity* PRODUCTION

Noted for maintaining original accuracy over a longer period. Criterion Heads are smooth, compact, rigid. Parts subject to wear are hardened. LEAD SCREW IS HARDENED TOOL STEEL, WITH THREADS GROUND FROM SOLID AFTER HARDENING. All heads have large, graduated dial. Large offset adjustment eliminates need for offset boring bars. Two sizes: 1½" and 3". ½" and 1" bar capacity. Shanks are interchangeable, enabling operator to use head on different machines. Ideally adapted for slide boring tool holder on small turret lathes. Ask your dealer or order direct. Request free literature.

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FASTER SPEEDS *and* LONGER LIFE

HIGH SPEED CENTERS

between grinds on lathes and grinders equipped with RED-E High Speed Steel centers because they have high speed steel ends. All tapers and sizes. *Write for Bulletin.*

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IRANISTAN & R. R. AVENUES
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NICHOLSON *EXPANDING* MANDRELS PROMOTE PRECISION

And, secondly, they CUT COSTS . . . two big reasons why Nicholson Expanding Mandrels are recognized as "standard" in the nation's machine shops. Set of 19 does the work of 209 solid arbors, for all bores from ½" to 7". Two types, all sizes; sold singly or in sets. Prompt delivery. Bulletin 1043.

Other Products: Traps, Control Valves, Arbor Presses, etc.

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STAMPS BOTH LETTERS AND FIGURES INTO STEEL AND ANY METAL OR PLASTIC

WRITE FOR LITERATURE

THE ACROMARK CO.
ELIZABETH, NEW JERSEY

ESTABLISHED!!

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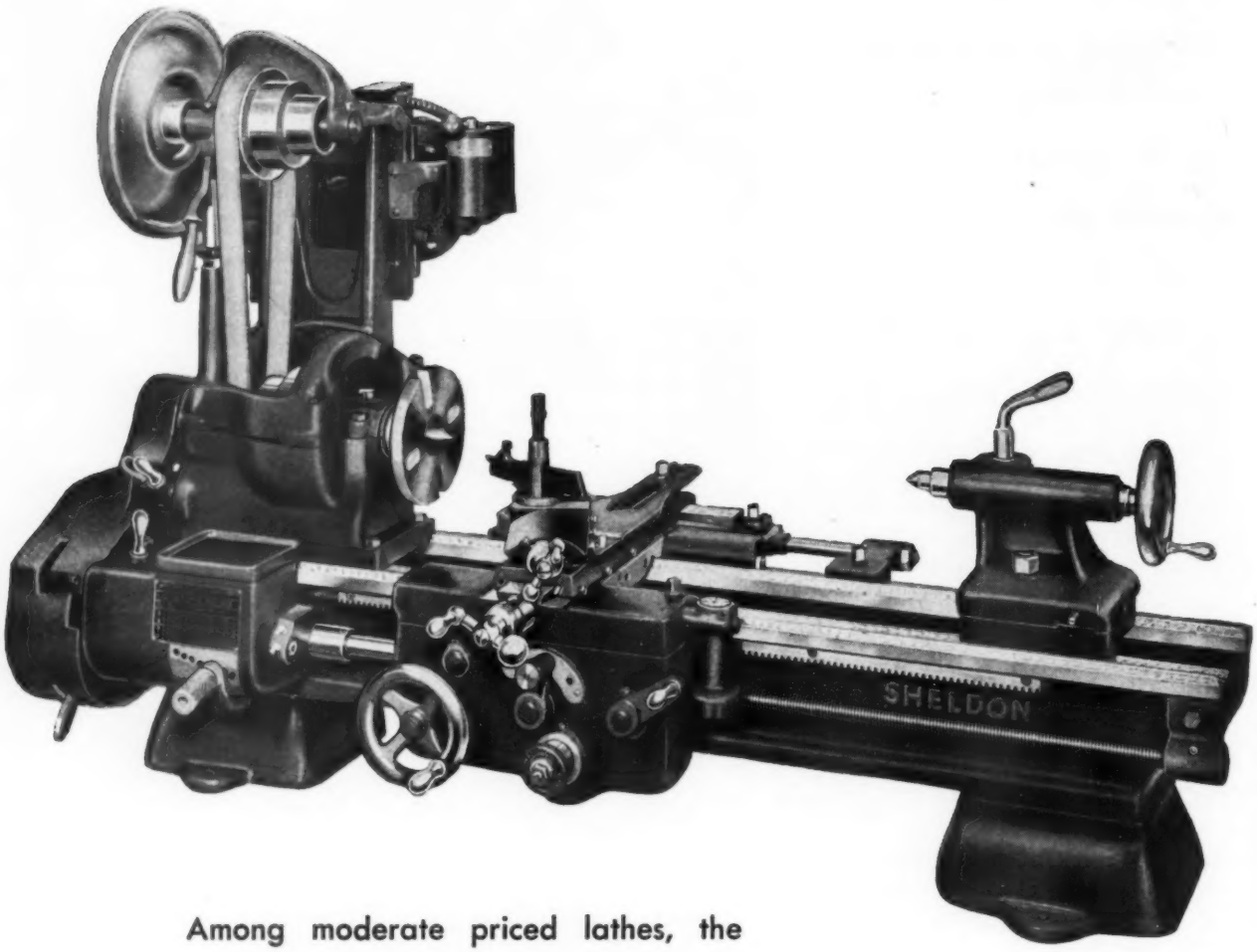
MILLIONTHS OF AN INCH FOR SALE BY **VINCO**

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Hub Gages • Built-up and Special Gages • Gear Rolling Fixtures • Spline and Index Fixtures • Hydraulic Power, Control, Utilization and Distribution Units • Engineering, Design and Development.

SHELDON

PRECISION LATHES



Among moderate priced lathes, the SHELDON 1026 BMWQ is not only superior in design, workmanship, features and precision, but in its convenient, space-saving and **more efficient** overhead motor drive . . .

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There's nothing "touchy" about the heat-treating of any steel in the Big 8 assortment. There isn't a prima donna in the lot.

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They make it easy for you to know your tool steels.

Clearly, it's easier for your men to learn the properties and heat-treatment of 8 steels than to attempt the mastery of 12 or 20 or 25.

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(water-hardening)

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(oil-hardening)

Omega
(maximum shock-resistance, cold work)

No. 67 Chisel
(maximum shock-resistance, hot work)

Air-Hardening
(low distortion during heat-treatment)

Lehigh Die & Tool, H Temper
(high-production die steel)

No. 57 Hot Work
(maximum red-hardness in hot work)

No. 66 High Speed
(general-purpose high-speed steel)

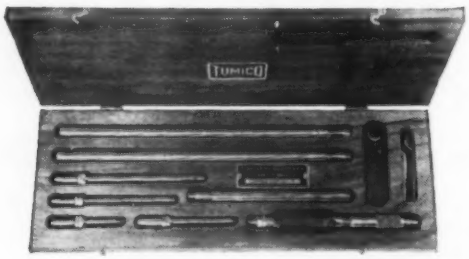
A minute saved is a minute earned, especially in these times. Bethlehem's Big 8 will save you many minutes, many dollars, many headaches. If you're interested in simplifying tool-room practices, get the full story from the nearest Bethlehem distributor.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Bethlehem Steel Export Corp., New York City

★ ★ ★ BETHLEHEM STEEL ★ ★ ★

Tubular MICROMETER

FEATHER TOUCH



INSIDE MICROMETER SETS TU-MI-CO TUBULAR Construction—strong, light, easy to assemble and handle. All tips and connecting surfaces are hardened and lapped for long, trouble-free service. Sets complete with mandrels, wrenches, instructions—in strong wood cases.

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If you are having trouble in preparing ferrous or non-ferrous metals for black oxide finishing, investigate what Oakite degreasing and cleaning materials can do for you!

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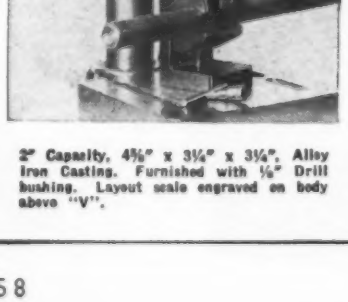
Right in the Lead

THE GEOMETRIC TOOL CO.
NEW HAVEN 15, CONN.



2" Capacity, 4⅝" x 3¼" x 3¼". Alloy Iron Casting. Furnished with ⅛" Drill bushing. Layout scale engraved on body above "V".

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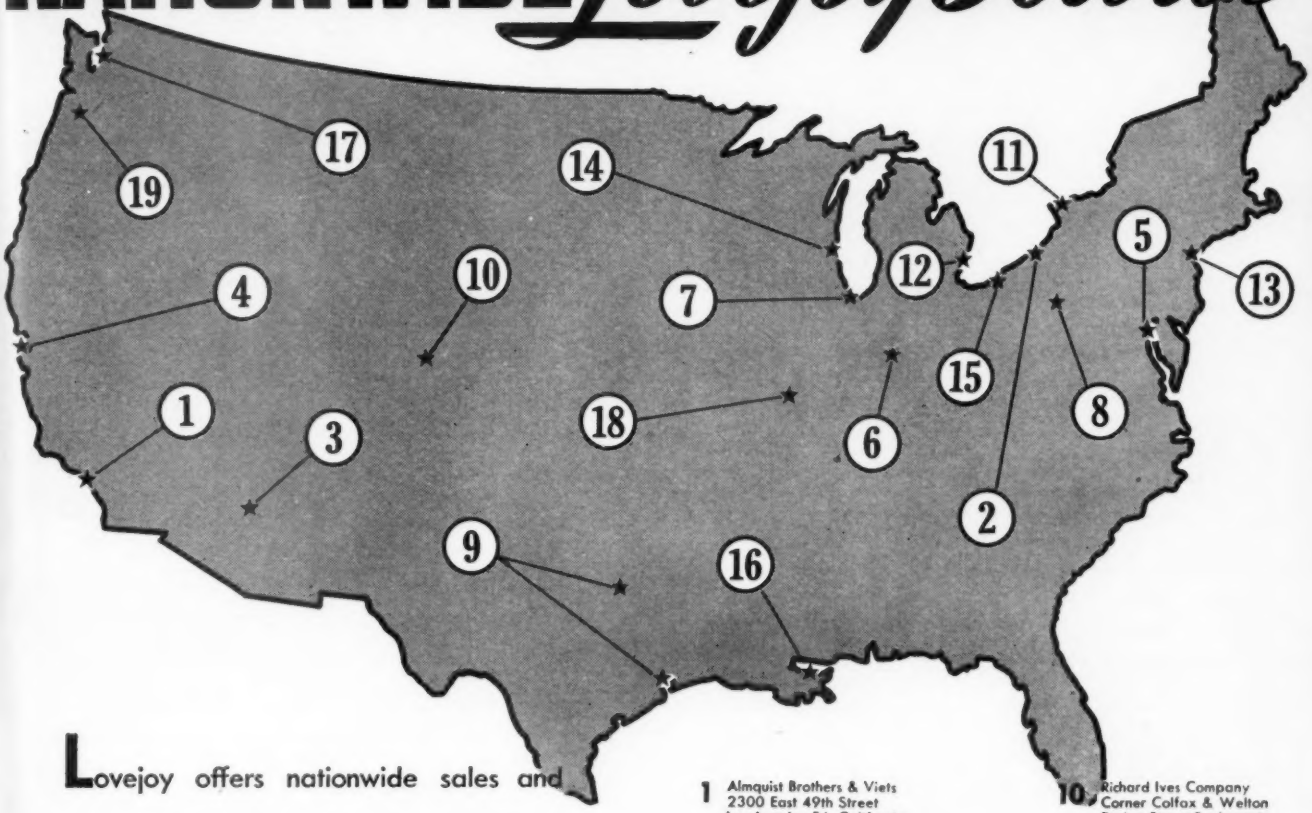

Lovejoy offers nationwide sales and service for its outstanding line of inserted blade cutting tools. The representatives listed here are completely equipped to solve your milling and cutting problems. They have the know-how and engineering background that can save you time and money. Call on them — or, as a start, write to them for the new Lovejoy Catalog.

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6 Mr. Walter F. Greene
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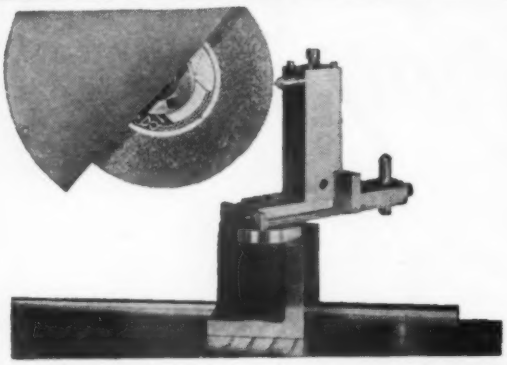
Lovejoy TOOL COMPANY, Inc., SPRINGFIELD, VT., U.S.A.

MILLING CUTTERS | BORING HEADS | ARBORS | SPOT FACING TOOLS | COUNTERBORES | BORING BARS | SINGLE POINT TOOLS | TURRET TOOL POSTS

The "FORM-MASTER"

ANGLE & RADIUS DRESSER



An all-purpose angle and radius dresser for high-precision at low cost. Accurate easily within .001". Simple to operate. Dresses in vertical position enabling operator to SEE the form in work. All parts hardened and ground (except cast-iron base which can be drilled and tapped). Suitable for surface and cylindrical grinders. Two 1/3 ct. diamonds and instrument case included. $150.00.

It readily produces: Any desired angle
Convex radii to 4" on 7" wheel
Concave radii to 7" on 7" wheel

Specifications: Base 3" x 3", height 8½"
Wheel capacity 10"
Angular travel 3"

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Manufactured by

J. & S. TOOL CO.

477 Main Street East Orange 1, N. J.

"PRECISION DRESSING TOOLS"

QUICK ON THE DRAW

The AIR-MASTER's powerful suction instantly draws dust and grit off the whirling wheels of buffers and grinders. It keeps these millions of gritty destroyers of health and machinery from escaping into the air—from entering the lungs of your employees—from injuring sensitive parts of expensive machinery. The AIR-MASTER is quick on the draw. Dust and Grit don't have a chance. The AIR-MASTER is fully self-contained—efficient, rugged, dependable. A size for every grinder and buffer. Write today for full details.

NOW AVAILABLE—Two, Three and Five H.P. grinders and buffers on AA-5 priority or better.

The Cincinnati

ELECTRIC DRILLS • GRINDERS • BUFFERS • PORTABLE TOOLS

The Cincinnati Electrical Tool Co.

DIVISION OF THE R. K. LE BLOND MACHINE TOOL CO., CINCINNATI, OHIO

2615-6 Madison Rd.

PALMGREN

ANGLE—DRILL PRESS—PRODUCTION VISES

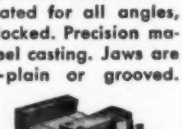
No. 000 ANGLE VISE

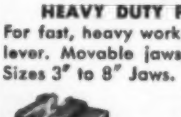
Mounted on Swivel "M" Base

For Drilling, Milling, Grinding, Filing, Fitting, Etc. Permits setting up of angle work accurately and quickly without clamps, wedges or make-shift methods. Accurately graduated for all angles, once set it stays locked. Precision machined of semi-steel casting. Jaws are hardened steel—plain or grooved. Sizes 1½" to 8".

HEAVY DUTY PRODUCTION VISES

For fast, heavy work. Adjustable cam locking lever. Movable jaws, hardened and ground. Sizes 3" to 8" Jaws.



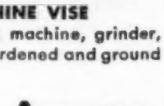


FLANGED MILLING MACHINE VISE

Clamps to table of milling machine, grinder, etc. For heavy work. Has hardened and ground jaws 6" wide, 2" deep.

DRILL PRESS VISES

For every purpose. Accurately machined, best semi-steel castings. Long bearing adjusting screw. Jaws hardened steel—plain or grooved. Sizes 1½" to 4".



No. 250 MILLING ATTACHMENT VISE

MAKES MILLING OPERATIONS POSSIBLE ON LATHE

A necessary fixture for small shops and emergency work in large shops. Fits 8"-9"-10" South Bend, Atlas, Craftsman, Sheldon or other lathes of similar sizes. Has graduated vertical angle adjustments. Easily mounted on cross slide and held by one T-Slot bolt. PALMGREN VISE has 2½" Jaws opening full 2½". Depth Jaw 1-7/16", one plain and one grooved jaw for holding round pieces. Height 10½", Price $24.75.

WRITE FOR CIRCULAR AM31. Contains full description and prices of our complete line of vises.

CHICAGO TOOL and ENGINEERING CO.

8354 South Chicago Avenue Chicago 17, Ill.

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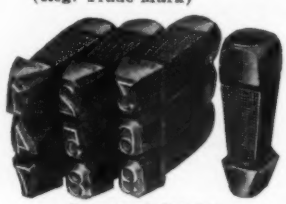
(Reg. Trade Mark)



Pat. No. 2,089,794

- Deeper impression with less exertion
- Will not spall, will not mushroom
- 25% to 50% more service
- Any size character from 1/16" to 1"

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M.E. CUNNINGHAM CO.
SAFETY STEEL STAMPS

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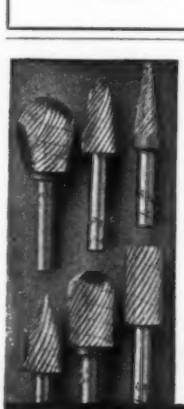
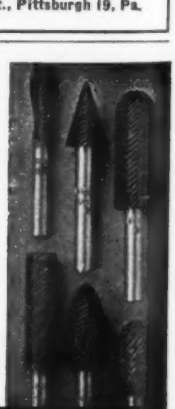


Grobet

ROTARY FILES

Hand Cut • Milled Cut Ground from the Solid



There is a GROBET ROTARY FILE in shape, size and coarseness of cut for every type of hard or soft metal, plastic, wood, etc. GROBET FILES do their jobs better and stay sharp longer.

Send for catalog DR, the most complete of its kind illustrating and describing GROBET Rotary Files, Diesinkers, Burs, Tube Burring Cutters, Chatterless, Countersink, etc.

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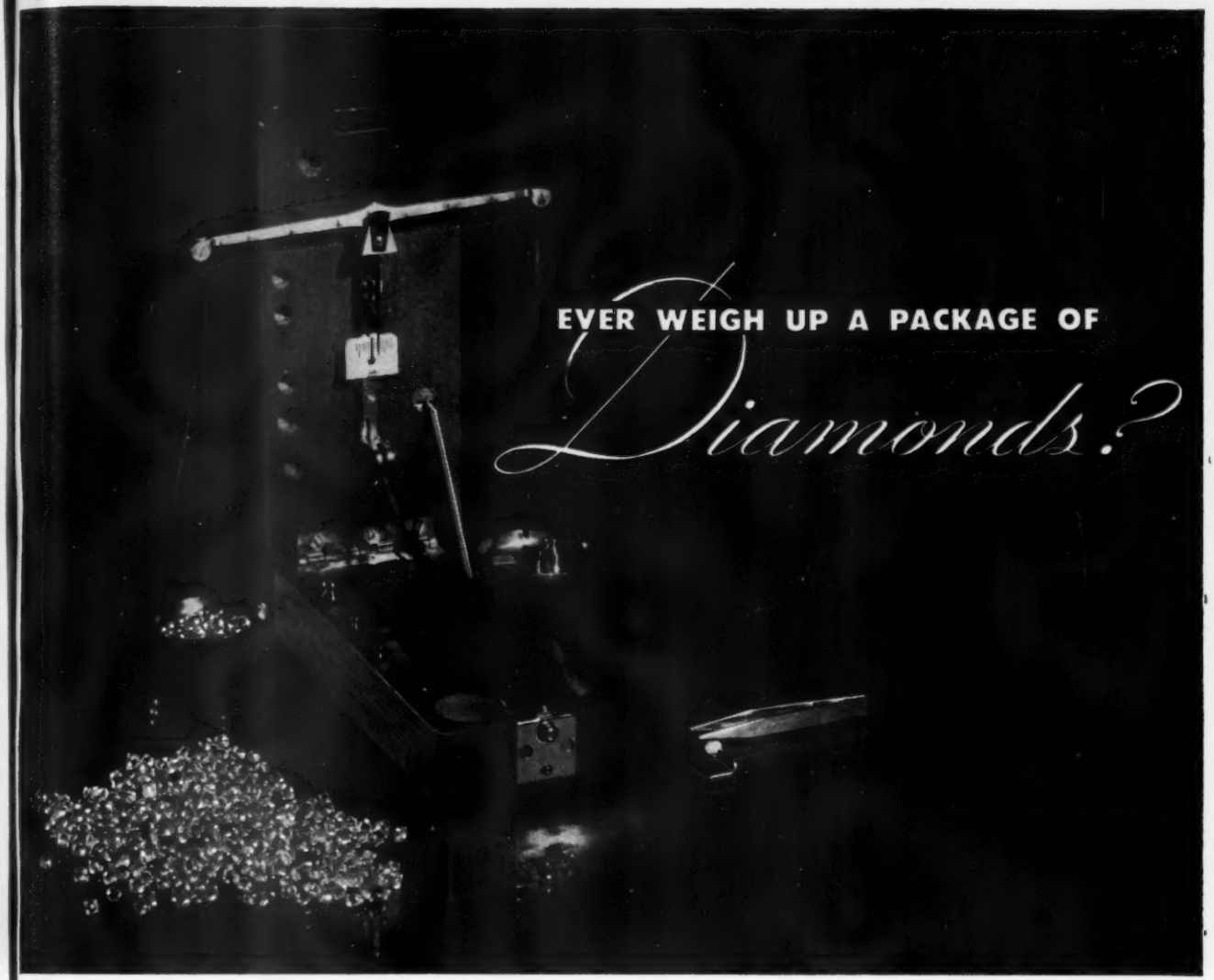
IMPORTERS OF GROBET SWISS FILES MFRS. OF GROBET ROTARY FILES

Plants: New York • Chicago • Los Angeles



This ingenious little scale (which folds up and fits comfortably into the coat pocket) is a familiar sight on the desk of many a production man, purchasing agent and grinding room superintendent. It is part of the Wheel Trueing man's kit when he is showing the fine industrial diamonds for which Wheel Trueing is famous.

If you want to weigh up some of the stones, this little balance will give you the answer down to a hundredth of a carat or up to two hundred carats at a time. And, many thousands of carats of Wheel Trueing diamonds pass over these scales in the course of a year.

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Wheel Trueing sales offices, located throughout the country, are equipped to show you splendid selections of the finest quality industrial diamonds and to give you the benefit of wide experience in the use of diamonds.

Your inquiry will receive prompt attention.

Send for a copy of our booklet "Tips on Using Diamond Tools." Every diamond tool user or operator should have one.

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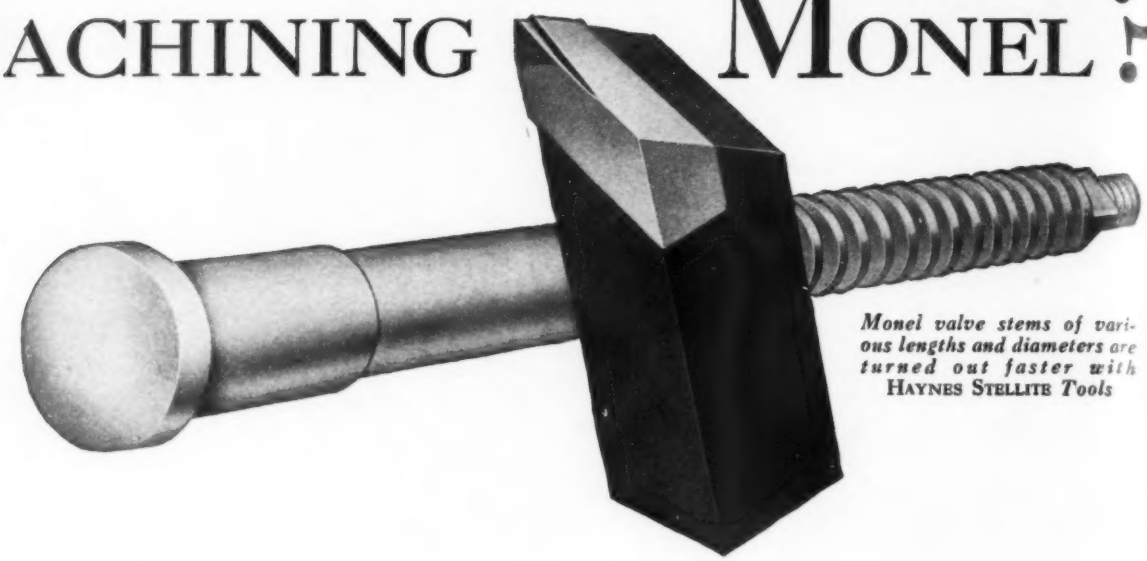
MACHINING MONEL?



Monel valve stems of various lengths and diameters are turned out faster with HAYNES STELLITE *Tools*

Read about the Job this HAYNES STELLITE Tool is doing on Monel Valve Stems

● This 1-in. square box tool, fabricated in the user's shop by brazing a HAYNES STELLITE 98M2 tip to a steel shank, does the combined rough- and finish-turning of valve stems made of cold-rolled Monel at a speed of 557 r.p.m. . . . 240 surface feet per minute . . . with a feed of .021 in. and a ⅜-in. depth of cut.

After 30 hours of use, the tool shows no signs of wear. The tool is ground to provide a 15-deg. side rake angle and a 15-deg. back rake angle; end and side relief angles of 6 deg.; a radius of 1/32 in. . . . and no lead angle.

Another HAYNES STELLITE tool subsequently cuts the acme thread at 297 r.p.m. . . . 72 surface feet per minute, with a cut of .020 in. per pass.

If you are machining Monel, a letter or phone call to our nearest office will bring a representative to tell you more about the production records HAYNES STELLITE cobalt-base alloy tools are making on this metal . . . and also on steel, cast iron, bronze, and other materials.

If you prefer, you can learn more about 98M2 tools . . . and how they can be used to reduce floor-to-floor time and machining costs . . . by writing to Kokomo for the descriptive booklets illustrated here.

Price List—For a descriptive price list of HAYNES STELLITE 98M2 metal-cutting tools, write and ask for Form 5783.

●

Operating Information — This new booklet is full of operating information on 98M2 Tools. To obtain a copy, simply ask for Form 5350.

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

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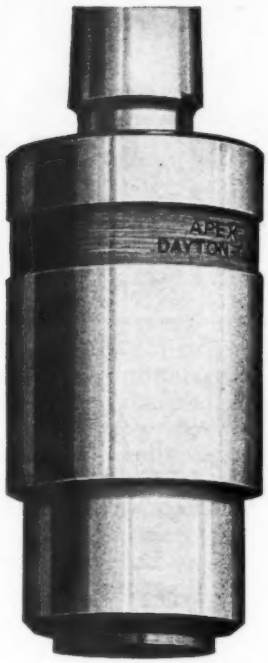
BUY UNITED STATES WAR BONDS

• HIGH-PRODUCTION METAL-CUTTING TOOLS •

"Haynes Stellite" is a registered trade-mark of Haynes Stellite Company.



In every detail Apex Safety Friction Tapping Chucks are *right*!

You can operate your drill presses and radials to CAPACITY with Apex Safety Friction Tapping Chucks. They minimize tool breaking, save time and materials, and help green hands produce more, faster.

Precision-built throughout, these chucks are made of finest materials for the job. They are easy to adjust and, once adjusted, maintain the proper tension over long periods. End thrust set up by tapping or drilling, or pressure exerted by operator on spindle, does not affect friction setting.

Safe and simple to operate. Send for catalog.

APEX

THE APEX MACHINE & TOOL CO., DAYTON, OHIO

Manufacturers of Safety Friction Tapping Chucks, Quick Change and Positive Drive Drill Chucks, Vertical Float Tapping Chucks, Parallel Floating Tool Holders, Power Bits for Phillips, Slotted Head and Clutch Head Screws, Hand Drivers for Phillips and Clutch Head Screws, Aircraft and Commercial Universal Joints, Plain and Universal Joint Socket Wrenches.

GOOD *Lighting is Lighting* ENGINEERED *to the Seeing Need of Each Worker's Task*

Better TOOLS SPEED AND IMPROVE

Good workmanship takes good tools. Lighting is the "seeing" tool — the tool which controls the worker's ability to produce speedily and accurately his precision task. Like any efficient tool, the kind, quantity and positioning of illumination on the job should be designed to provide the seeing condition best suited to the work at hand. General overhead lighting, alone, is usually inadequate. It cannot efficiently supply the quantity of illumination needed for precision work. It cannot direct illumination to proper seeing position on vital work areas. Localized lighting solves this problem. Engineered to each individual task, light in proper quantity is directed by the worker exactly where and as needed. In proper combination with general lighting, the resulting Balanced lighting gives each worker the right seeing tool at lowest cost.

FOSTORIA *Localites for Intense Lighting of Critical Work Areas*

—PUTS ILLUMINATION EXACTLY WHERE WANTED

Instant Adjustability
No screws or nuts to loosen and tighten. Vibration-proof joints hold arms in any position desired.

Unit Reflector and Socket Holder
Sturdy, fool-proof construction prevents socket separation.

Mountings
Equipped with choice of 5 bases for any type mounting.

MODEL 3470-P-172-SV
Concentrates up to 300 footcandles intense illumination on critical work area. Recommended for bench and table operations, assembly, sorting, inspection.

MODEL 3267-U-172
Concentrates up to 250 footcandles intense illumination on critical work area. For small part assembly and inspection, and certain precision machining.

MODEL 3267-FLB-170
Concentrates in excess of 100 footcandles fluorescent lighting on critical work area. Recommended for certain bench assembly and inspection work.

MODEL 3267-C-172-SV
Concentrates up to 150 footcandles intense illumination on critical work area. Recommended for large machine tools and similar equipment.

MODEL 3267-H-102-SV
Concentrates up to 200 footcandles intense illumination on critical work area. For small machines, lathes, grinders, drill presses, etc.

BALANCED LIGHTING
fostoria
GENERALITES for Overall Lighting • LOCALITES for Light ON the Job
NEMA
Trade Mark
Reg. U. S. Pat. Off.

FOSTORIA
Specialists in

Careful Study of Critical Work Areas

Determination of Lighting Required

for Better SEEING
CRITICAL WORK PRODUCTION

IMPORTANT BENEFITS OF BALANCED LIGHTING

Increased Production
Enables workers to see faster and comfortably which speeds their task.

Fewer Errors
Quick, accurate seeing avoids costly mistakes.

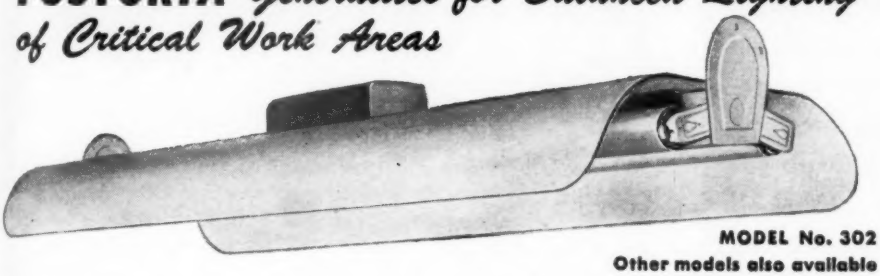
Reduced Accidents
Good seeing guards against accidents.

Better Work Morale
Comfortable seeing conditions increase morale.

Lower Costs
Faster and better production reduces costs.

Lower Investment
Balanced lighting usually takes less equipment and saves maintenance expense.

FOSTORIA *Generalites for Balanced Lighting of Critical Work Areas*



MODEL No. 302
Other models also available

Better Fluorescent Lighting—Easier to Install—Easier to Maintain

Fostoria Generalites light instantly. Troublesome starters are eliminated to end maintenance problems and replacement expense. There is no interruption of light on voltage drops as low as 50V. The practical reflector permits easy removal for cleaning during lamp operation — a definite maintenance advantage. The high efficiency control of illumination obtained with this reflector is the result of excellently designed shielding, a unique "V" type wiring channel which minimizes pocketing of light, and a radiant energy baked WHITE enamel finish on steel with reflection factor in excess of 85%. Unusual ease of mounting singly or in continuous row is provided for any requirement.

INVESTIGATE THIS BETTER LIGHTING

Your lighting problems in the hands of Fostoria Industrial service will receive expert analysis and recommendation. Write, today, for complete catalog with Balanced Lighting facts and the specific advantages to you of Fostoria Service.

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Industrial Lighting for Better Seeing

Recommendation of Lighting Installation

After-Application Service

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Independently Affiliated Manufacturers:
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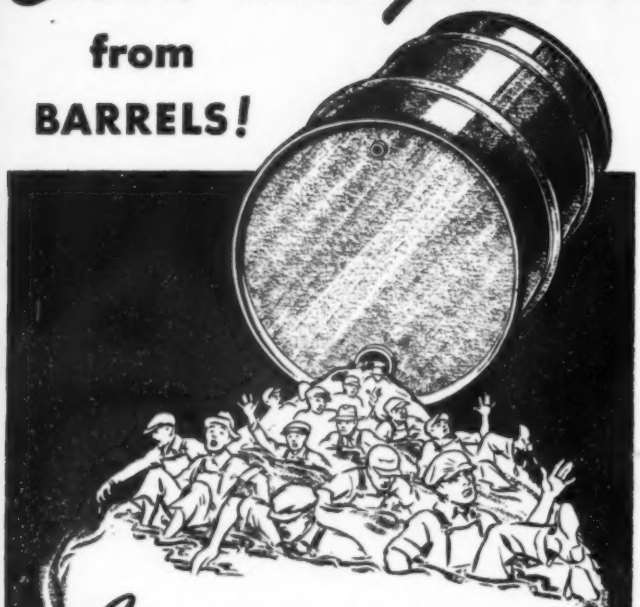
Extra Manpower from BARRELS!



CORRECT APPLICATION of correct cutting fluids reduces rejects, improves finish, prolongs tool life, lessens down time . . . with the result that machinists have less trouble, get more done, better and quicker.

Adding productive man-hours by working with cutting fluids is an every day occurrence with Stuart men. They are backed by a complete line of laboratory controlled cutting fluids made by a company of eighty years experience. They know how to evaluate properly all the factors which affect the selection of a cutting fluid.

Call for the FREE services of a Stuart man. Let him help you to attack your manpower problem from a new angle.

The Stuart 60-page booklet, "Cutting Fluids for Better Machining," is full of specific data, well illustrated. Write for your free copy.

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LIMITED
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ESTABLISHED 1865
Warehouses in Principal Metal-Working Centers

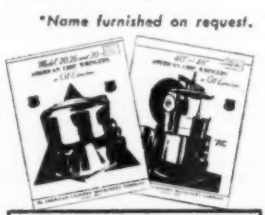
$1600 A YEAR....CLEAR!

A New York state manufacturer* compared cutting oil bills for two 3-week periods—before and after installing an American Chip Wringer. For the three weeks the Chip Wringer was in use, cutting oil bills were *$372.59 less.*

Labor cost to operate the Chip Wringer (two men, each on 11-hour shift) was $262.74 for the three weeks. This still left a saving of $109.85, or $36.61 a week. Then, deducting 20% depreciation on an investment of less than $1500 for the Chip Wringer (including electric hoist) left a net saving per week of $30.84. Thus, the American Chip Wringer is saving this manufacturer *more than $1600 clear per year.*

We'll gladly help you figure how much money an American Chip Wringer will save *you.* No obligation. Write us today!

*Name furnished on request.



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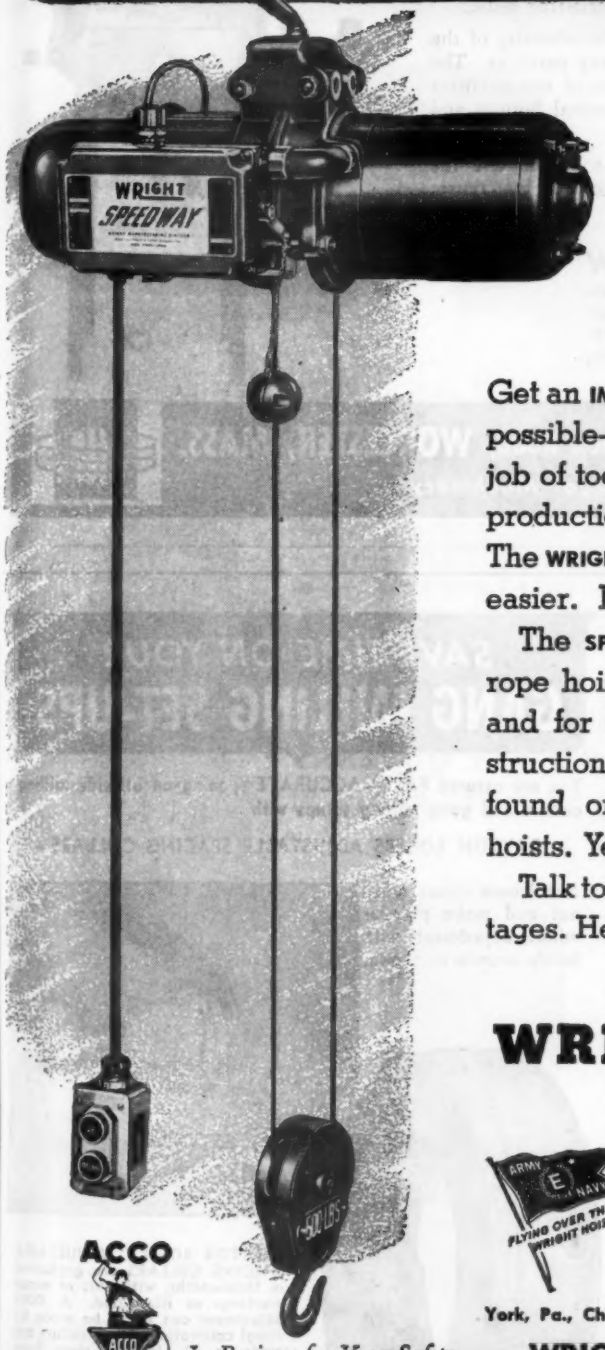
Fully illustrated, describing five different models of American Chip Wringers

ARMY E NAVY
CINCINNATI PLANT

In only 3 minutes, an American Chip Wringer reclaims more than 90% of the cutting oil from a load of metal chips or machine turnings. It can be operated by any unskilled person.

The AMERICAN LAUNDRY MACHINERY COMPANY
CINCINNATI 12, OHIO

...SPEED IS ESSENTIAL TODAY ...AND TOMORROW



..THE SPEEDWAY IS WRIGHT

Get an **IMPROVED WRIGHT SPEEDWAY ELECTRIC HOIST** as soon as possible—not only for the help it will be in the hurry-up job of today, but for the necessary speed and lowered production costs it will afford both now and tomorrow. The **WRIGHT SPEEDWAY ELECTRIC** speeds up work, makes jobs easier. It saves labor time, cuts handling costs.

The **SPEEDWAY ELECTRIC** is a sturdy, lightweight, wire rope hoist, designed for fast lifting on assembly floors and for general use. Designed with spur gear construction, magnetic control and mechanical features found only in the more expensive production-type hoists. Yet it is priced economically low.

Talk to your **WRIGHT** distributor about **SPEEDWAY'S** advantages. He is listed in your classified telephone directory.

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PREVENT CONTAMINATION – EXTEND TOOL LIFE

with the NEW BARRETT COMBINATION STERILIZER AND SEDIMENTOR for CUTTING OILS . . . .

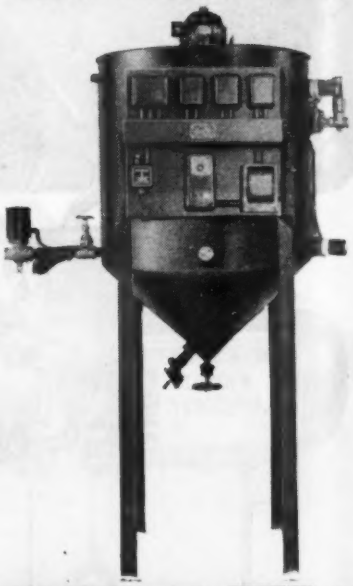
Protects your operators against infection—insures more and better work from your cutting tools—by sterilizing your cutting oils and precipitating sediment *at the same time.*

The NEW BARRETT STERILIZER AND PRECIPITATOR combines these two operations in one piece of apparatus which can be depended on to handle both operations effectively, efficiently and economically. Sterilization is by heat and is a positive active operation in the line ahead of the supply tank. By locating in this position, contamination is intercepted before the cutting oil is conditioned for safe, bacteria-free reuse.

Because of the heat to which the oil is subjected during sterilization, the viscosity of the cutting oil is reduced, thereby encouraging precipitation of minute heavy particles. The sediment thus liberated settles out and drops by gravity to the bottom of the sterilizer where provision is made to scrape the precipitated solids from the conical bottom and clean them out.

By thoroughly and constantly sterilizing and effectively removing solid matter, the Barrett Combination Sterilizer and Sedimentor reconditions cutting oil for reuse; sterilized for safety's sake and abrasive-free for longer tool life.

Barrett Sterilizer and Sediment Precipitator arranged for fully automatic operation.



GET COMPLETE INFORMATION NOW

These units are available for floor, wall and post mounting and are furnished with semi-automatic or full automatic control as required. Send at once for detailed information on this timely Barrett development.

THE LEON J. BARRETT COMPANY, 1800 Grafton Road, **WORCESTER, MASS.**

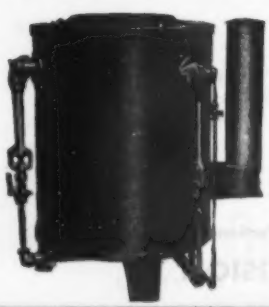
Designers and Builders of Centrifugal Machinery

"BUZZER" HIGH SPEED *Gas* FURNACES

2400 F.°

Attained quickly with "Buzzer" Full Muffle Furnaces designed primarily for heat treating high carbon and alloy steels.

NO BLOWER or POWER NECESSARY . . . just connect to gas supply



"BUZZER" Atmospheric Pot Hardening Furnaces assure even heat up to 1650° F.

Used for Salt, Cyanide and Lead Hardening. Also adapted for Melting Aluminum.

Send for the complete "BUZZER" catalog today.

CHARLES A. HONES, INC.

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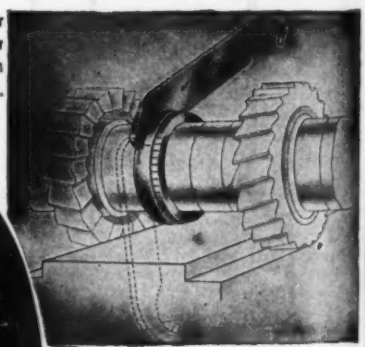
SAVE TIME ON YOUR GANG MILLING SET-UPS

You are assured FAST—ACCURATE spacing on all side milling cutters and gang milling setups with

DAYTON ROGERS ADJUSTABLE SPACING COLLARS

Just loosen cutter arbor nut and make plus or minus adjustment with handy wrench as shown.



"DAYTON ROGERS" ADJUSTABLE SPACING COLLARS are graduated in thousandths, with plus or minus markings as illustrated. A .0005 adjustment can easily be made by visual calibration. These collars are made in 12 standard sizes from ⅞" to 2".

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Established 1888

D.O.James

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Horizontal drive. 8 sizes. Ratios 1¼ to 9:1. ¾ to 50 HP. 1458 RPM to 128 RPM.

MOTORIZED PLANETARY REDUCER
Horizontal drive. 35 sizes. Ratios 10 to 1200:1. ¾ to 75 HP. 172 RPM to 74 RPM.

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Horizontal and vertical drive. 11 sizes. Ratios 6 to 65:1. ⅛ to 30 HP. 310 RPM to 25 RPM.

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Vertical drive. 35 sizes. Ratios 10 to 1200:1. ¾ to 75 H.P.
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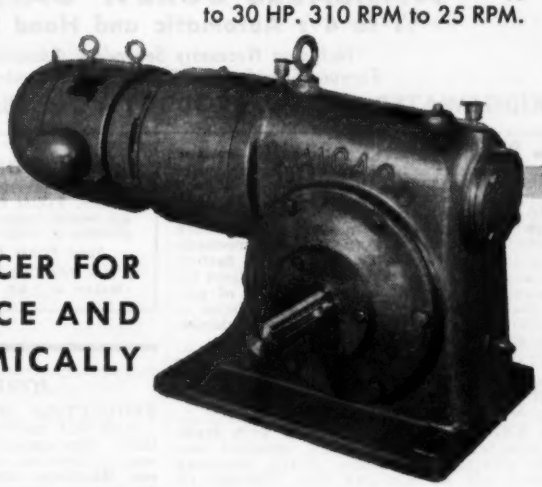

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MOTORIZED → HELICAL REDUCER
Vertical drive. 8 sizes. Ratios 1¼ to 9:1. ¾ to 50 HP. 1458 to 128 RPM.

The design and manufacture of D.O.James motorized reducers embodies all the high quality of construction of our standard gear reducers. In addition to this in-built quality you have many advantages — such as compactness, lower cost and elimination of separate supports, thereby saving valuable floor space. D.O.James Motorized Reducers are manufactured to drive up, down, horizontally or at an angle.

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Over 57 years makers of every type of gear and gear reducer.

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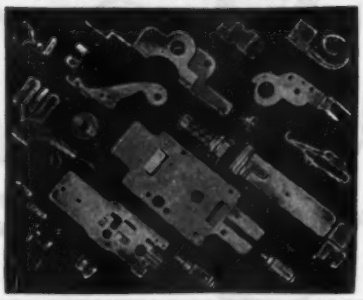
STAMPINGS AND ASSEMBLIES
IN ALL KINDS OF METALS



Fast and efficient service on long or short runs is guaranteed by our modern equipment and methods, backed by 50 years of experience.
We also offer facilities for the manufacture of screw machine products, tools, dies, jigs and fixtures.
Quality work by skilled mechanics is assured. Send your blueprints or samples today.

"GREATER SAVINGS WITH GREIST"

THE GREIST MFG. CO.
546 BLAKE ST. NEW HAVEN, CONN.

PLANT EMPLOYING 200 PEOPLE HAS PRODUCTION TIME OPEN

- CENTERLESS
- TURRET
- MILLERS
- SHAPERS
- GRINDERS
- LATHES
- SUPPORTING EQUIPMENT

Over 200 Machine Tools

BERGEN MACHINE & TOOL CO., INC.
189 Franklin Ave., NUTLEY 10, N. J.

• Machines and Parts, • Special Tools and Fixtures, • Cam Milling, on Contract

Your engineering problems will receive efficient and economical service in our modern plant manned with skilled workers. Contact us today for prompt quotations on your blueprints or samples.

Designers and builders of wire and ribbon stock forming machines.

THE A. H. NILSON MACHINE COMPANY, BRIDGEPORT, CONN.

METAL STAMPINGS
• TOOLS • DIES •
PERMANENT MAGNETS
HEAT TREATING
THOMAS & SKINNER
STEEL PRODUCTS CO.
1103 E. 23rd St. INDIANAPOLIS, IND.

AVAILABLE SCREW CAPACITY
¼ to 4½ Automatic and Hand Screws

Including Necessary Secondary Operation
Forward Samples and Blueprints for Quotations

BRIDGEWATER SCREW PRODUCTS CO., Bridgewater, Mass.

WIRE AND METAL SPECIALISTS
in round, flat, square and special shaped wire in all metals.
LARGE PRODUCTION CAPACITY
Plating and finishing.
EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

PRECISION FORM GRINDING
Specialists in grinding Circular and Flat FORM-TOOLS, FORM Counterbores, FORM Flat-Drills, and related types of FORM grinding. Also step-grinding of Tungsten and Molybdenum Rods.
Send Prints for Quotation and Delivery
J. & S. TOOL CO.—477 Main St.—E. Orange 1, N.J.
(Makers of J.&S. Radii & Engle Dressing Tools)

PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us – we will take care of them.
GENERAL PATTERN WORKS
2233 Buck Street Cincinnati, Ohio

SEARCHLIGHT SECTION

POSITIONS VACANT

MECHANICAL ENGINEER—Old established company now converted to pre-war production (Essential Products) has opening for mechanical engineer with some machine design factory layout and installation experience. Excellent future possibilities. Give complete details of personal qualifications and work history in letter of application. Address P-956, American Machinist, 330 W. 42nd St., New York 18, N. Y.

DRAFTSMAN EXPERIENCED with drawing dies, tool and jig layout, post-war positions, excellent conditions. P-164, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

TOOL AND diemakers experienced with drawing dies for post-war position, excellent conditions; give full particulars. P-163, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED
METAL SHAPING, FORMING AND FINISHING MAN

With production experience in metal processing and finishing operations. For problem work with service representatives of manufacturer of drawing, stamping, cutting and cleaning materials. Products essential in all kinds of production and maintenance work. Excellent future. Location New York City. Must be willing to travel. Give details of age, experience, etc.

Box 567, Church St. Annex, N.Y.P.O.

POSITION VACANT

Exceptional opportunity for right man. Large machine tool distributor in Chicago District needs experienced machine tool correspondent. Write giving full particulars, experience, age, etc.

P-173, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Illinois

SEARCHLIGHT SECTION

POSITIONS VACANT

PRODUCTION MANAGER. Able to estimate costs and operate large metal trades plant in Ohio. Fine opportunity. Give fully age, experience, references, salary expected. P-204, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

MECHANICAL ENGINEER—Old established company now converted to pre-war production (essential products) has opening for mechanical engineer with some machine design, factory lay-out, and installation experience. Excellent future possibilities. Give complete details of personal qualifications and work history in letter of application. P-205, American Machinist, 330 W. 42nd St., New York 18, N. Y.

(Additional Position Vacant ads on opposite page)

EMPLOYMENT SERVICE

SALARIED POSITIONS—This advertising service of 35 years recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 366 Delaware Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

DESIGNER ENGINEER—Chief engineer of Ohio plant employing 125 people desires change. Prefer California, West Coast, or Southern states. Available sixty days. Know production tooling. Capable tool, die, jig, fixture, and machine designer. 40 years old. Desire similar position. Experienced in negotiating contracts. PW-209, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

POSITIONS WANTED

WORKS MANAGER plant or factory manager. American, 49 years. Wide and varied experience in aircraft, automotive, machine tools, machine and die making, general jobbing. Held positions as plant and factory manager, general superintendent; master mechanic, tool superintendent, strong and rapid increase in production. Practical tool and diemaker, technical education. Thoroughly versed on handling organized labor, grievances and negotiated contracts. Last two positions have tripled gross output. Am now employed. Right connection more desirable than salary. PW-186, American Machinist, 330 W. 42nd St., New York 18, N. Y.

MANUFACTURING EXECUTIVE: Thoroughly familiar with all phases of modern high quality, high quantity, low cost production. Automotive background and training. Excellent war record managing plant producing gyroscopic fire control instruments and all types of electrical devices. Age 50. Available April. PW-206, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

METHODS ENGINEER, 40 years of age, who served machinist apprenticeship, received mechanical engineering degree, graduated from large company engineering training course, been in charge of methods and tool design departments, has done an exceptional job in lowering manufacturing costs in industries that make small equipment as well as those that make large mechanical equipment, would like to change from present position to some company that desires to do a better job in manufacturing. Middle west preferred but not essential. PW-207, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

(Continued on opposite page)

WANTED
ENGINEERS MACHINE DEVELOPMENT

Graduate engineer or equivalent, experienced in the design and development of special and experimental machines. Men with creative ability required, experienced in such lines as automatic, semi-automatic, or ordnance equipment. Must be thoroughly acquainted with modern methods and shop practices and capable of developing new ideas in conjunction with modern mechanical laboratory facilities.

State age, marital status, details of education, experience, draft status, present salary and salary expected. Enclose recent photograph or snapshot.

Post-war opportunity.

Applicants must be able to obtain Statement of Availability.

E. I. du Pont de Nemours & Company, Inc.
Personnel Division
Wilmington 98, Delaware

WANTED
INDUSTRIAL ADVERTISING MAN

REQUIREMENTS Preferably from 30 to 35 years old—technical education or mechanical background an advantage—a born desire to write, and with self-starting flair for ideas—should have had all round advertising experience—ability to meet people easily and secure their cooperation in gathering desired information.

THE JOB Is with an old-established firm in central Massachusetts with excellent post-war prospects—includes a little of everything—photography—layout work—writing copy for bulletins, house organ, trade papers, etc. —needed as general man to assist Advertising Manager—good future for the right person.

IF INTERESTED Send us your complete personal and business history: include age, marital and draft status, education, places and dates of employment, salary expected. Your letter will be held in strict confidence. WRITE—

P-212, AMERICAN MACHINIST
330 West 42nd Street
NEW YORK 18, N. Y.

WANTED
SALES ENGINEER
with
EXPERIENCE IN MACHINE TOOLS

capable to contact customers and to handle all related correspondence. Steady employment. New York City.

Write full details, age, experience, and salary expected

SW-194, American Machinist
330 West 42nd Street
NEW YORK 18, N. Y.

WANTED
MECHANICAL ENGINEER

In light metal stamping and screw machine work.

ALSO

EXPERIENCED DRAFTSMAN

Good opportunity in old established company. Give full particulars as to experience and salary desired.

P-190, American Machinist
520 North Michigan Avenue
CHICAGO 11, ILLINOIS

PACIFIC NORTHWEST AND ROCKY MOUNTAIN STATES

An Able and Active Agency
Established Connections
Complete and Faithful Coverage:
Industrial — Hardware — Automotive

FREDERICK JOHNSON COMPANY
Manufacturers' Agents since 1929
Branch Denver, Colo. — *Terminal Sales Bldg.* Seattle, Wash.

SALES OFFICE AND PERSONNEL AVAILABLE

Desires connection with well established company whose product must be handled by technically trained men. Office located in industrial center of Michigan. Will cover all middle west states if necessary.

SA-179, AMERICAN MACHINIST
520 North Michigan Ave., Chicago 11, Illinois

WANTED
MACHINE DESIGNERS

Experienced on the design of special machinery. Excellent opportunity for first class men interested in steady positions in New England.

Only men 35-55 with a record of successful achievements will be considered. In replying furnish information preliminary to a conveniently arranged interview.

P-140, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

MAKE EXTRA MONEY
simply—easily—IN YOUR SPARE TIME

If you work with other industrial men, you can earn profits in spare time by recommending McGraw-Hill technical books to fellow workers. Write for details to E. KASK, Dept. A, 330 West 42nd St., New York City 18.

Flexible joint of modern design for underground Conveyor Belts required for the British Coalfields. Would entertain agency or manufacturing rights. Write

BO-202, AMERICAN MACHINIST
Aldwych House, Aldwych, London, W.C.2

WANTED — POST WAR PRODUCTS

A Denver manufacturing plant with adequate capital, production facilities, and sales force to market a large number of products, wishes to contact designers who have developed tools, hydraulic equipment, domestic heating units, automotive parts and accessories, household items, or electrical devices which will find a nation-wide market. Will contract on a royalty basis or purchase all patent rights.

PAUL WHITAKER — **1325 Acoma, Denver, Colorado**

POSITIONS WANTED
(Continued from opposite page)

INDUSTRIAL ENGINEER wants connection progressive concern. Twenty years experience metal fabrication industry. Competent in tool design, production, plant layout. Long or short time arrangement. Available soon. Address P. O. Box 4713, Station E, Kansas City, Mo.

WORKS MANAGER plant superintendent 42 years engineering background, experience light, heavy machinery, jigs, fix, design, mass production. Rate structure union, non-union labor, 24 years shop experience. Modern labor, PW-208, American Machinist, 330 W. 42nd St., New York 18, N. Y.

SALESMAN AVAILABLE

SALES ENGINEER A-1 designer engineer, experienced in the machine tool, cutting tool, and heating and ventilating fields desires change. Know Ohio, Indiana, and Michigan territory, but would prefer South or West. Able draftsman, and can handle any technical correspondence. Would be interested in high class field job, or position as sales manager. SA-210, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

REPRESENTATIVE AVAILABLE

WANTED: 26 years machine tool experience in Indiana. Would like allied or repeat business. RA-211, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

BUSINESS OPPORTUNITIES

PATENT FOR Sale Car Heater—the most simple, efficient, and inexpensive to manufacture. Further details write V. Turdin, Hope Hill Road, Wallingford, Conn.

PUT YOUR Patents to work. Responsible firm of 22 years experience in patents and licensing, desires items for development. Prefers ideas adaptable licensing exclusive basis. Will buy outright or take exclusive franchise. Can develop special machinery if necessary. Submit patent or drawings. Explain prospects, competitive products and basis will do business. BO-189, Amer. Mach., 520 N. Mich. Ave., Chicago 11.

PATENT ATTORNEY

PATENTS, COPYRIGHTS, Booklet, "General Information concerning Inventions and Patents" and "Free Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453,815-15th St., N. W., Washington 5, D.C.

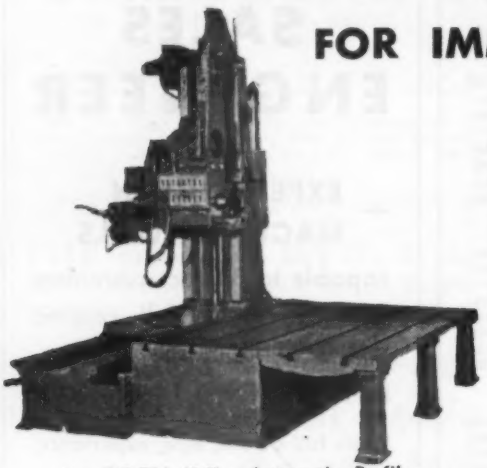
(Additional opportunity advertising on page 272)

KELLER DIE SINKERS

FOR IMMEDIATE DELIVERY

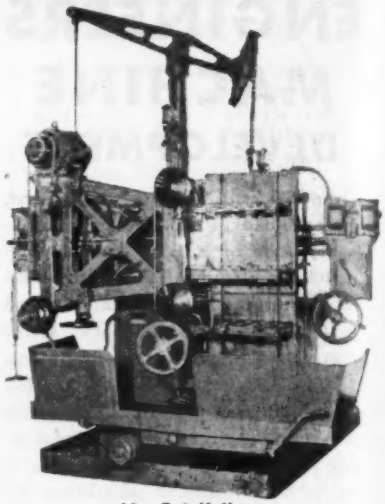
EMERMAN MACHINERY CORP.

875 W. 120th St.
CHICAGO 43, ILLINOIS



No. BG-724 Keller Automatic Profiler for Die Sinking, Milling and Profiling

Die capacity — face 88" x 48" depth with standard table 30" depth with extension table 58"
Head vertical travel 48"; horizontal travel 72"
Spindle head travel 18"
Maximum reach of spindle 24"
Center distance between cutter and spindle tracer max. 50½"; min. 35½".
Working surface standard table 88" x 30"
Working surface extension table 88" x 58"
Equipped with panel board and switch boxes
Vertical feed drive motor—¾ HP. 110 volts, vary RPM, Ohio D.C.
Cutter spindle motor—2 HP. 115 volts, Gen. Elec. D.C. motor
Column drive motor—⅝ HP. intermittent duty, 115 volts, G.E. D.C.
Horizontal traverse motor—⅛ HP. 115 volts, Ohio D.C.
Weight approx. 16,500#



No. E-6 Keller Die Sinker

Die capacity 20" x 27" face x 12" high
Work table 20" x 50"
Cross slide travel 24"—.002" to .040" feed
Table speeds 4" to 24" per minute
Distance between 24"
Spindle speeds 620 to 3600 RPM.
Complete with motors, coolant system and splash guards
Weight approx. 6850#

3 AVAILABLE IN STOCK

WANTED TO BUY

Principals, long established and experienced in machine shop business are interested in buying for cash any established manufacturing business.

We prefer such opportunities where, after sale, personnel will remain and where the present owner will continue to supervise production at an attractive salary. We would furnish overall management, supply orders, new equipment, capital, etc. Send brief description of product and activity with first letter.

Area within 30 miles of Newark, N. J., preferred.

BO-176, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

FOR SALE

Complete rights and title on a quick change punch for sheet metal dies. A good war or post war opportunity, copies of patent will be furnished.

Graham Products Engineering Co.
Lansing 6, Michigan

COMPLETE TOOL & DIE JOB SHOP

To be sold as going business. Located about 50 miles from Chicago. In a good industrial city in Indiana. Equipment consists of ten lathes, two turret lathes, eleven grinders, nine drills, five millers, four shapers, presses, boring bars, compressors, and misc. Complete detailed information on request.

IRON & STEEL PRODUCTS, INC.
13498 S. Brainard Ave. Chicago, Illinois
"Anything containing IRON or STEEL"

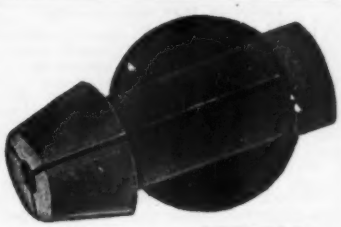
TOOLS—DIES—MACHINE SHOP

Sales $400,000 year up; est. 30 years; 100 machines; new lathes—automatics—turrets—jig borers — millers — grinders — shapers — drillers — punch presses, etc.; modern 2 story brick plant 60x130; rented bldg. 50x100; employ 60; capacity over 100; excellent labor conditions; fine personnel; city over 100,000; ample work; excellent postwar; with property $350,000.

THE APPLE CO., Brokers, CLEVELAND, O.

USED COLLETS

FEED FINGERS — PADS



ACME No. 515, No. 52, No. 53, No. 54, No. 55, No. 56.
ACME-GRIDLEY 1⅜".
Cleveland ⅞" to 2½".
Cone 1¼", 1½", 2½".
Foster No. 1, No. 2, No. 3, No. 4, No. 5, No. 7.
Gridley, Models F, ¾", ⅞", 1¼", 1⅜", 2¼", 2⅜", 3¼", 4¼".
Model "G" Gridley, ⅞".
No. 4 & No. 6 Warner & Swasey.
Bardons & Oliver, Brown & Sharpe, Davenport, Garvin, and New Britain.
Change Gears, Lead Cams, Form Cams, No. 53 to No. 56 Acme.
Form & Lead & Cut-off Cams for ⅞" G. Gridley.
Spindle gears, finger holders, collet tubes, push tubes, spindles, nose pieces for 2⅜" F. Gridley.
Large stock 1⅜" F. Gridley Collets.

SPECIAL
Master Collets and Master Feed Fingers for 4" Cone Automatics.

MONA

GRAFF MACHINE TOOL COMPANY
7140 So. Halsted Street *Vincennes 9664* **Chicago 21, Ill.**

IF YOU ARE DOING DEFENSE WORK

Send for Our Latest Circular Covering Bargains in Small Tools Such as Drills, Reamers, Turret Attachments, etc.

DEWITT TOOL COMPANY
173 Grand St. New York City

No. 75A HEALD INTERNAL GRINDER

NEW IN 1941

TWO MOTOR DRIVE, EQUIPPED WITH CROSS SLIDING WORKHEAD, MICROMETER STOP. 220 VOLT AC MOTORS. VERY FINE CONDITION.

BARRON MACHINERY CO.
33 N. CLINTON STREET
CHICAGO 6, ILLINOIS

EVERY ITEM GUARANTEED AS REPRESENTED

FALK FOR DEPENDABILITY IN REBUILT MACHINERY

MORE VALUE FOR YOUR MONEY

• • • OUR INVESTMENT IS YOUR SECURITY
• • • SOUND RECONDITIONING

EXCEPTIONAL ITEMS FROM OUR MODERN STOCK*

SHEARS & BRAKES

Lennox Splitting Shear, 8' throat, ¾" cap., arr. M.
Lennox Bevel Shear, ¾" cap., arr. M.D.
Dreis & Krump Apron Brake, 10' x 10 ga., #204, motor driven.

PRESSES

#4 Bliss D.C. B.G. Forging 4" stroke.
#4½ Bliss D.C. B.G. Forging 4" stroke (2).
#4½ Bliss 3 column B.G. 3" stroke.
#5 Bliss D.C. B.G. Forging 3" stroke.

BORING MILLS

100" Niles-Bement-Pond Bor. & Turn. Mill.
Vertical, 48" Gisholt.
Hill 4" Bar Horizontal Table Type.
Horiz. #36 Landis-Rochester, 3½ Bar Floor Type—Floor Plate 72" x 120".
42" Bullard Vertical Boring Mill with side head; New Era Type.
54" Colburn Vertical Boring Mill.
No. 31 Lucas Horizontal Boring Mills 3".

DRILLING MACHINES

Cincinnati-Bickford 24", 4 spindle, #4 M.T. Table 20" x 67".
Avey, 2 & 3 spindle Prentice, 4 spindle.
Henry & Wright, 6 spindle.
Leland Gifford 2 spindle.
Woodward & Rogers 6 spindle.

RADIAL DRILLS

3' Dreses, 9" Rd. Column.
3' Arm 9" Col. Cincinnati Bickford
4' Arm 11" Col. Cincinnati Bickford.
5' Arm 11" Rd. Col. Cincinnati Bickford.
5' Arm 13" Rd. Col. Cinn. Bick. air clamp.
6' Arm 14" Col. Cincinnati Bickford

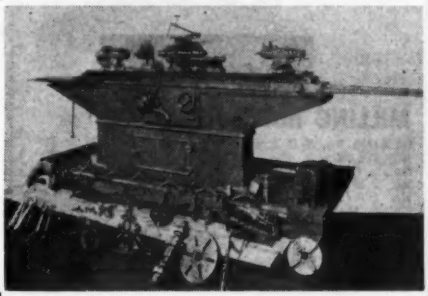
MULTIPLE DRILLS

Fox #15H 54 spindle hydraulic feed.
Natco #D-5, 10 spindles #1 M.T.

GRINDERS

16" Heald Rotary Surface Grinder.
#4 Brown & Sharpe Universal Grinder.
12" Heald Rotary Surface Grinder equip. with 9" Dia. Perm. Mag. chuck.
#2 Cincinnati Centerless Grinder, Filmatic.
#12 Greenfield Internal Hydromatic Grinder, sizematic type, complete with Tank and Pump. 15" swing, 5" hole, 4" dee.
Oliver Model 51 Drill Grinder; 1½" cap.
Pratt & Whitney 14x36 model B vertical surface grinder.
#2 Brown & Sharpe Surface Grinder.

Brown & Sharpe No. 4 Univ. Cylindrical Grinder, M.D., with regular equipment.



Capacity:—Centers swing 12" dia.; over water guards 10¾". Distance between centers 60". Takes wheels to 12" dia.x½" to 1" thick. Longitudinal Table travel — 10 changes in rate; range 1½" to 53 " per minute. Work speed—6 changes for live or dead center grinding. B & S No. 9 taper hole.

MILLING MACHINES

#4 & #5 Cinn., High Power, Plain, S.P.D.
No. 0 Bickett Vertical Bench Miller
No. 2 Cincinnati, High Power, Plain.
No. 2 Cincinnati, Motorized, Pyramid Col.
No. 2 Brown & Sharpe, Plain (4).
No. 1½ Brown & Sharpe, Plain (2).
#1 Kempsmith Universal, Cone Drive.
No. 1½ Valley City Universal, Cone Dr.
No. 1 Brown & Sharpe, Plain (6).
Ames Precision Universal Bench Mill.
P & W 2½" Duplex Spline Miller.
Hall Planetary Thread Miller 24".
No. 8 Lees Bradner Thread Miller
No. 1B Hendey Universal, cone drive.

PLANERS

120"x72"x35' Betts, 4 Heads, M.D.
72"x72"x18' Pond Heavy Pattern, 4 Heads.
48"x48"x12' Putnam Heavy, 2 Heads, M.D.
30"x30"x12' American M.D., 2 Heads.
30"x30"x10' Cinn. Heavy Pattern, 2 Hds.
20"x20"x36" N.-B.-P., Planer Shaper, M.D.

LATHES

Putnam 26 x 12 Heavy QCG, arr. for M.D.
American, 16 x 6 Q.C.G., Geared Head
Hendey, 16 x 10 Q.C.G., Turner M.D.
Potter & Johnston #6A Automatic Chuckers; 3½" dia. hole in spindle (2).
LeBlond 14 x 6 Q.C.G.
Seneca Falls Tool Room 14 x 6, Q.C.G.
20 x 10 Lodge & Shipley, G.H., M.D., Taper Att. (2).

SHAPERS AND GEAR CUTTERS

26" Cincinnati Triple Geared, Belt Dr.
#61-2 Fellows 36" Gear Shapers (2).
12" Schuchart & Schutte Gear Hobber.
#1 Adams Gear Hobbers, Belt driven (3).

BENDING ROLLS

Bertsch 3" x 3" x ⅜" angle bending roll.
Niagara pinch type 7' x 7" roll motor driven.

SLOTTERS

Betts 36" Geared Slotter, Motor driven, 54" dia. Rotary table.

MISCELLANEOUS

J. C. Miller Co. Lacq. Heater with acquistat.
Heat Treating Furnaces for the tool room.
Sleeper & Hartley #1 Wire coiling machine for making BX cable.
50 K.W. Moesta Gun Welder Transformer, portable, 25 cy. 440 volts.
Grinding Wheels for #2 centerless 4" face, 20" diameter.
Blake and Knowles 12x2x12 Simplex Type, Hydraulic Steam Pump, 2000 lbs. pressure with 80 to 125 lbs. steam, delivers 9 gallons per minute.
Niagara #98 Brake & Folder, 72" cap. 14 ga. arranged M.D.
#228C Greenlee Vertical Hollow Chisel Mortizer, Power feed, M.D.
No. 7B High Speed Riveting Hammer, cap. ¾" to 1½". New this year.

HEADQUARTERS FOR POWER PRESSES

**The above list, selected from our current stock, is subject to prior sale or subsequent additions. Hence we urge your prompt inquiries on any of these machine tools or others in which you are interested.*

BUY FROM STOCK
Telephone
MAIN 6347-6348

FALK MACHINERY COMPANY

Machinery Merchants

18 WARD ST.
ROCHESTER 5
N. Y.

ENGINEERED-REBUILT
THE SIMMONS WAY

Every machine listed in this column is in our warehouse at press time.

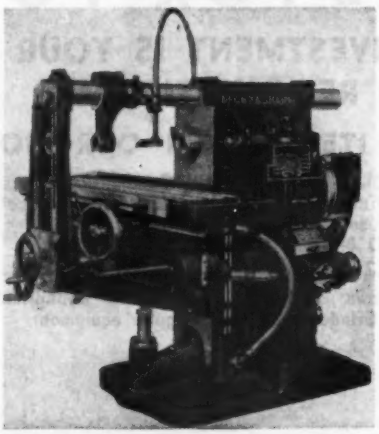
●

2¼" Bar LUCAS Horizontal Table Type Boring Mill, M.D.
2½" Bar CLEVELAND Horizontal Table type Boring Mill, M.D.
5" Bar DETRICK-HARVEY Floor Type Horizontal Boring Mill, M.D.
42" BULLARD, NEW ERA, 1100 serial
42" N-B-P Car Wheel Borer, M.D.
66" N-B-P Vertical Tire Mill
4' HAMMOND Sensitive Radial Drill
6' CARLTON Motor-on-Arm, Plain
7' CARLTON Motor-on-Arm, Plain
8' N-B-P Motor-on-Arm, Plain
#16 BLANCHARD Surface Grinder
33"x9" G & E Spur Gear Cutter
27" BRIDGEFORD Axle Turning Lathe
29" PUTNAM Axle Turning Lathe
42" PUTNAM Car Wheel Lathe
36"x18' N-B-P "TIME SAVER" Lathe
#2 CLEVELAND Plain Miller, M. D.
#4 B & S Universal Miller, M. D.
#5 B & S Plain Miller, M. D.
#8 BECKER Vertical Miller, M. D.
#10 N-B-P Heavy Vertical Miller
24"x24"x12' INGERSOLL Plain Miller
24"x36"x12' INGERSOLL Side Miller
30"x36"x12' INGERSOLL Planer Miller
30"x30"x10' NEWTON Slab Miller
30"x30"x12' N-B-P Planer, Two Rail Heads, 230 volt D.C.
36"x36"x10' WOODWARD-POWELL Planer, 4-Heads
48"x48"x24' N-B-P Planer, 3-heads, M.D.
60"x48"x12' CINCINNATI Planer, 3-heads
72"x72"x18' N-B-P Heavy Planer, 4-heads 230 volt, D.C.
RT-40 SCHULTZ-NAUMANN Beam Shear
5" Capacity U.E.F. Alligator Shear
72" 105 Tons L & A Multiple Punch
6"x6"x⅝" Double Angle Shear
12" SELLERS Crank Slotter
20" SELLERS Crank Slotter
2" LANDIS Pipe Threader
6" BIGNAL-KEELER Pipe Threader
30' H & J Plate Planer, M.D.

SIMMONS ENGINEERED Machine Tool REBUILDING

SIMMONS MACHINE TOOL CORP.
1759 North Broadway, Albany, N. Y.
N. Y. Office: 50 East 42nd St.

Exceptional TOOLS



MILLING MACHINES

PLAIN: No. 5-B Brown & Sharpe AC, M.D.
No. 4 LeBlond, Hvy. Duty, 16¼x66" table, M.D.
No. 4 Cincinnati, 16½x64" table, M.D.
No. 2-M Cinc. Rest. overarm, 10½x53", P.F.
No. 2-A Milw. dble. over. rapid traverse.
No. 2 Hendey Norton, back grd., P.F.
No. 2 B & S Heavy, Sgle. back gear, P.F.
PRODUCTION: 3-Prast. New ±MMI U.S. Multi-Mills
No. 45 Productomatic, rotary table.
8—Prast. New 18" Cincinnati Automatics
2—18" Cinc. Automatics.
No. 10 VanNorman Duplex.
10" Pratt & Whitney Semi-Auts., 6⅝"x18" table.
PLANER TYPE AND SLAB: 42x36"x12' Beaman & Smith Openside; 42x42"x13' Ingersoll Slab.
UNIVERSAL: No. 1 Kompamith; No. 1-B K&T.
VERTICAL: No. 3 Brown & Sharpe 14½x49" table.
No. 2 Brown & Sharpe, B.G., 10¼x38½" table.
No. 2½-B Kearney & Trecker, 14x70" table.
2—Vernon verticals; No. ETAOINSHRDLSHRDLU
THREAD: 6x72" Pratt & Whitney, M.D. with motor.
6x48" Pratt & Whitney; No. 3 Lees Bradner, B.D.

SLOTTERS and SHAPERS

14" Newton, 30" table, A.C. Motor drive.
3—No. 74 Douglas Vertical Slotters.
14" Ohio, single geared, with c/s.
Betts, 9" stroke, Power feed.
72" Morton drawcut, 18' travel.

MDNA MEMBER

LATHES

FLOOR: 50"x18' Fitchburg, D.B.G., M.D.
36"x17' American Grd. Hd., Q.C.G., A.C. M.D.
30"x14' Fifield, L.C.G., Back geared, M.D.
30"x12' LeBlond, Q.C.G., M.D. with motor
18"x12' Ledge & Shipley 12-speed, M.D.
2—18x8' Americans, Q.C.G., Dble back grd.
17"x8' L.C.G., 4-jawchuck.
16"x6' L & S, Q.C.G., Dble back grd., T.A.
16"x6' Pratt & Whitney, grd hd., S.P.D., T.A.
16"x7' Blaisdell, L.C.G., Back grd., M.D.
16"x6' Hendey, Grd. Hd
14"x6' L & S, Q.C.G., taper att.; 14"x6' LeBlonde.
14"x6' Bradford, Grd M.D.; 12"x8' & 12"x6' Lodge & Shipleys; 14"x4' L & S, B.G.
8" Sundstrand Stub, S.P.D., Power feed.
30' Pit, 156" face plate, int. face plate drive.
Pit Lathe, 86" swing over ways, 115" bet.
TURRET: No. 4 Warner & Swasey, B.G., P.F.
6—No. 2-A Warner & Swaseys, motor drive.
No. 1 Warner & Swasey, M.D.
28" Niles, 4¼" hole, power feed, M.D.
26" Libby Univ., T.A. bar feed, 2⅞" hole.
No. 16 Gisholt Simplimatics, 21" & 23" swing, S.P.D.
No. 6 B & S, Fric. Hd., 2-1/16" hole, B.G.
20" Foster Univ., motor drive.
18' Libby, Grd. Hd., 3-9/16" hole, motor drive.
No. 3 Foster & Woods; No. 2 Bardons & Oliver.
Jones & Lamson Grd. Head, A.C. motor drive.
2¼x24", bar feed, 2¼x24" Chuckers (2).
3" and 2" Jones & Lamson.

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No. 2 Brown & Sharpe Turret Former, M.D.
2½" Gridley Sgle. Spindle Auto., M.D.
No. 55 Natl. Acme; No. 652 New Britain Aut.
Nos. 2 & 3 Manville Wood Screw Machines.

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GLEASON 10" Spiral Bevel Gear Generator
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CINCINNATI #2 Ver. Miller—M.D.
CINCINNATI #3 Ver. Miller—M.D.
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B. & S. #3 Ver. Miller—M.D.
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GLEASON 12" Straight Bevel Gear Generator
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1—5' American triple purpose plain radial drill, motor on arm.
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6' American Triple Purpose Plain Radial Drill, M.D.

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5' American Triple Purpose Pl. Rad. Drill.
6' American Triple Purpose Pl. Rad. Drill.
6' Cincinnati Bickford Plain Radial Drill.
7' Cincinnati Bickford Plain Radial Drill.
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12" x 96" Landis Plain, S.C.
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FOSDICK 3¼' Radial Drill, G.B., M.D.
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BORING MILLS, Rockford, 3⅛" bar, Horizontal, 24x72" table, M.D.
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GRINDER, Brown & Sharpe #2 Universal M.D.
GRINDER, Brown & Sharpe #5 Plain, M.D.
GRINDERS, Cincinnati 12" x 18" Plunge Cut
GRINDERS, Bryant #3 Internal, M.D.
GRINDERS, Rivett #103 Internal, M.D.
GRINDERS, Diamond Surface #2, M.D.
GRINDERS, Pratt & Whitney, 14" Vertical Surface, M.D., 9x31" Magnetic Chuck
LATHES, American 14"x6' & 20"x8', M.D.
TURRET, Foster Universal, #2B, M.D.
MILLING MACHINES, #29 Ohio Universal, M.D.
MILLING MACHINES, #2B Rockford Universal, M.D.
MILLING MACHINES, Becker Vertical #5 & 6
MILLS, Briggs Production Type A&B
PLANER, Ohio 42" x 42" x 12' One Head, M.D.
PLANER, Gray 30" x 30" x 8', 2 Rail Heads

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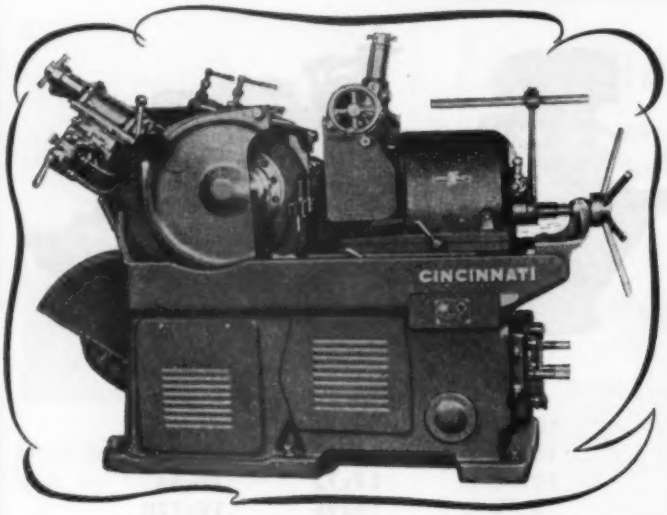

Cincinnati No. 2 Centerless Grinding Machine

Capacity: Stand. work rests 1/10" to 3½" diam., low thrufeed work rest 2" to 4¾" diam. In excellent condition with following equipment: arrgd. for 8" wide wheel with equip. for 4" wheel mounds; 1 profile diamond truing attmt. over grinding wheel; 1 profile screw type truing attmt. over regulating wheel; one 4" infeed work rest arranged for auto. ejectors; 1 auto. ejector 4" infeed work rest; motor and equip. completely wired, motor mounted, etc., 220/3/60 with control box. Phil-matic bearings.

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1—B & S No. 4 Univ. 12"x60", comp. equip.
1—Morse No. 2 Univ. 10"x30" full equip.
1—Taft Pierce No. 2 Univ., capac. 10"x30".
1—Bath 10"x22" Univ. Cyl. Grind. with attmts.
1—Greenfield Hydroll Int. No. 51, cap. 10", forge depth hyd., M.D.
1—Bryant No. 3B Int. Grinder, max. grind. lgth. 2".
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2—Bryant No. 12 Int. Hole Grinders, Fact. M.D., 15½" swing, Wheel Slide Trav. 10½", Max. grind. lgth. 8".
1—Bridgeport Wet Tool Grinder, No. 5, 36"x4" wheel, M.D.
1—Modern 12"x36" Self-Contained Pl. Cyl. Grind., swing 12".

1—Campbell No. 302 Abrasive Cutting Machine capac. 22" wheel travel, clearance top of tabl. to bottom 10" wheel—0".

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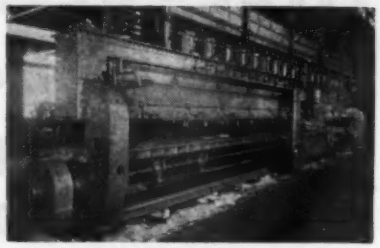

36' SELLERS PLATE PLANER, 34 pneumatic holddowns, motor drive with motor and control.

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60x44"x12' Gray, 4 hds., M.D.
44x36"x12' Gray, 2 hds. on rail.

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44x38"x15' New Albany.
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CIN. 48" Pl. Auto. Miller M.D.
NILES 12" Vert. Slotter
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BLANCHARD 26" Vert. Surf. Grinder
DIAMOND M. D. Horiz. Surf. Grinder
CLEVELAND 2½" Bar M.D. Horiz. Boring Mill
BROWN SHARPE #3 Pl. Horiz. Miller
NILES 84" M.D. Vert. Boring Mill 2 HDS.
SMALLEY GENERAL #23-A Thread Miller
AMERICAN 24" x 12' M.D. Grd. Hd. Lathe

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36" x 16' Bridgeford Heavy Turning Lathe, 6 Spindle Speeds, 2 Speed Motor 220 volt, 60 cycle, 3 phase, Apron Control Clutch and Brake, Takes 9' Between Centers. Been used for turning eccentric forgings and now in production. Price—$4,750.00 f.o.b. cars Cleveland. Delivery immediate.

36" Gould & Eberhardt Single Cutter Automatic Gear Cutter, suitable for jobbing work, being replaced by Hobber now in in use. Price—$500.00 f.o.b. cars Cleveland. Delivery immediate.

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84" Niles-Bement-Pond, 28' long, 17' centers, 72" geared face plate DC drive

32"x35' Wickes Grd. Hd., M.D.

36"x30' LeBlond Grd. Hd., M.D.

36"x30' Putnam Grd. Hd., M.D.

42"x16' Putnam, M.D.

32"x25' New Haven with raising blocks to 60"

30"x26' Lodge & Shipley 12 speed Geared Head, M.D.

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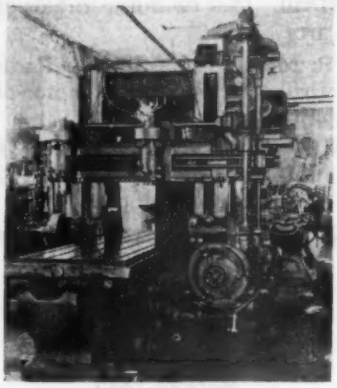

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2 5 Cincinnati Hi-Power Universal S.P.D.
4 Cincinnati Universal, 3 step D.B.G. M.D.
4 Cincinnati Hi-Power Plain, S.P.D.
4 Cincinnati Plain, 3 step D.B.G. M.D.
4B Brown & Sharpe Plain, Single P.D. M.D.
4 Milwaukee Plain Standard Knee Type, Horiz., M.D.
3 Cincinnati Plain Miller, D.B.G.
3 K.T. Milwaukee Plain, M.D. 1939
3½ Pratt & Whitney Duplex, Geared, P.F. to table, M.D.
3 Van Norman, S.P. 1942 Model
3 Cincinnati Vertical, Single Pulley, High Power
3 Cincinnati Universal, M.D.
Model C Becker Vertical, P.F. to rotary table, M.D.
2 LeBlond Plain, Back Geared, M.D.
Pratt & Whitney Automatic, P.F. to table
12 Brown & Sharpe Prod. M.D.
7 Becker, Lincoln Type
12"x48" Pratt & Whitney Thread Miller
Lees Bradner Thread Miller, 12"x36" 1941 Model
36"x36"x10' Ingersoll 4 Hds. Planer Type, M.D. adjustable heads
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08 Cincinnati Vertical M.D. 1941
A.B. Becker Vertical S.P.
OY Brown & Sharpe, P.F. to table
2B Kearney & Trecker Horiz S.P.
3 Cincinnati Vertical Hi-Power S.P.
2 Brown & Sharpe Univ. Horiz.
14 Cochrane & By Vert. Univ.

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48"x80"x24' Bed Fifield Lathe, D.B.G. M.D.
30" Houston, Stanwood & Gamble, Blocked to 64"x17', 10 HP Motor with grinding attachment and other parts
36"x14' Engine Lathe, B.G. Q.C. M.D. G.H.
30"x26' Lodge & Shipley Geared Head Lathe, M.D.
36"x28' Bridgeford Geared Head Lathe, Q.C. M.D.
30"x18' American Geared Head M.D.
20"x22' Whitcomb Blaisdell Lathe, D.B.G. Q.C. M.D.
22"x16' Prentice Geared Head, Q.C.G. Single P.D. M.D.
24"x12' Putnam Lathe, Blocked to 28"x12', D.B.G. M.D.
16"x8' Lehman M.D.
16"x10' Prentice M.D. and Taper Attach
16"x32"x8' Fay & Scott Gap Lathe
14"x8' Pratt & Whitney Lathe, M.D.
16"x6' National Lathe, Q.C.G. M.D.
13"x22"x5"x8' Barnes Gap Lathe, Standard Change
13"x5' Mulliner Lathe Q.C. M.D.
14"x20" 9 LeBlond Multi Cut Lathe, S.P. Geared Head

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24" Gould & Eberhardt B.G. M.D.
20" Steptoe, Gould & Eberhardt, Hendey, S.P. M.D.
18" Springfield, M.D.
16" Flather, Smith & Mills, M.D.

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Gridleys, 3¼", 1¾", 1¼", ¾" M.C. Single and 4 Sp.
23 New Britain Chuckers, 5½"

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Sellers Vertical, 100" M.D.
24"x36" & 42" & 54" Bullard new Era types
Bullard Vertical 42", 36" and 24" M.D.
Sellers Horiz. 6" M.D. 3" Universal 31 Lucas
Niles Horiz. 2¾" M.D.

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10"x48" Norton Surface, M.D. 1942 Model
14" Pratt & Whitney Vertical M.D.
Bridgeport Knife Grinder, M.D.
Springfield Vertical S.P. M.D.
70 Heald Internal, M.D.
9" Heald Rotar, Magnetic Chuck, M.D.
11 Brown & Sharpe
2 Brown & Sharpe Surface
4 Gallmeyer & Livingston Universal Tool & Cutter, M.D.
Taylor & Fenn Internal, Cushman Chuck
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10"x36" Landis self contained

TURRET LATHES

4x34 J & L Steel head, M.D.
1B Foster Universal, Geared Head 2" Cap. M.D.
Bardons & Oliver, 4½" M.D.
1" Foster, M.D.
2 Warner & Swasey, M.D.
Gisholt Tilliting 24" swing, M.D. 6"
Potter & Johnston Single Spindle for 3½" stock, Geared Head
2 Brown & Sharpe
6 Smur & Kamon 1½" M.D.

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64¼ Power, 1200 ton, 22" stoke, 75 HP Motor
Watson-Stillman Hydraulic 1000 tons 8" column
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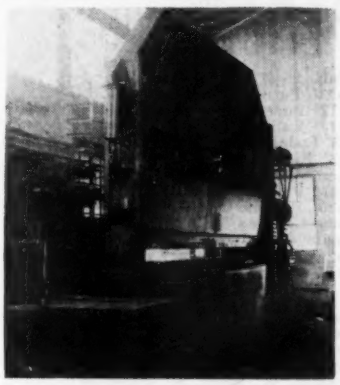
Robinson Power Press Brake 8' 16 Gauge
Geo. A. Ohl Press Brake 8' ⅜" MD
Adlerhurst Punch & Shear 1"x8" 25" Throat
Pels Punch & Shear on wheels 20 Pels
8' Stoll Power Shear, 14 ga.



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Ingersoll 60" x 44" x 16' Adjustable Rail Planer Type Milling Machine; 4 heads on top rail, 2 left-hand side heads, one right-hand side head; motor driven.
Ingersoll 30" x 30" x 10' Fixed Rail Planer Type Milling Machine; 3 horizontal spindles, 2 vertical spindles, M.D.
Van Norman No. 2 Duplex Milling Machine; vertical head, slotting head, dividing heads, single pulley drive.
Barnes 20" Camel Back Drill; Back geared, power feeds, B.D.
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Brown & Sharpe No. 2 Universal Cylindrical Grinder.
Marschke 10 H.P. Swing Grinder; Late type.
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Pond 84" x 72" x 20' Planer; 4 heads, 35 H.P. D.C. motor drive and controls.
Buffalo Angle Bending Roll; Capacity 3" x 3" x ⅜"; arranged M.D.
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Grob 20" Band Saw Filer; M.D.

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CHICAGO 6, ILLINOIS
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MDNA MEMBER

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Brake, Robinson 5' toggle
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Drill, Bickford 42" radial
Drill, 4-spindle sensitive
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Lathe turret 9 Bardons & Oliver
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Press 1 OBI motor drive
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Tool Grinder Sellers new 0, 1 and 2 magic chuck and collets.

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COLUMBUS, OHIO

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DRILLS

RADIAL: 7' American Triple Purpose, No. 6 M.T., Power feed, M.D. with motor.
6' American Univ., M.D. thru gear box.
6' American, 14" col grd motor drive.
4' Fosdick, 12" Col. M.D., 24x16" box table.
4' American, No. 4 M.T., 11" col. Grd. M.D.
3' Fosdick, No. 4 M.T., 10" column, P.F.
3' American, Maxi-speed sens., motor on arm.
FLOOR: 34" Barnes, B.G., No. 4 M.T., Power feed.
32" Prentice, No. 5 M.T., P.F., M.D.
6—24" Barnes Grd., M.D., round table
16" Avey, No. 2 M.T.
14" Henry & Wright, No. 2 M.T.
No. 14 Natco Mult., Arr. 20 spindles, P.F.
No. 12 Natco Mult., wwith 12 spindles, M.D.
8-spindle Mult., No. 4 M.T., M.D., 60" bet.
8-spindle Fox, M.D.; 6-spindle Leland Gifford
4-spindle Barr B.B., No. 1 M.T.
2, 3 and 4 spindle Aveys, 8" overhang, M.D.
4-spindle Adj. rail Moline Hole Hog, 12x42"
Weigel & Cine. Bickford Sgle. Sp. No. 4 M.T., M.D.

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6x12" Storm, Power feed, M.D.; 6x32" Norton.
No. 11 Brown & Sharpe; 3" Landis Race.
No. 22 Landis, 12x34"; 10x36" Landis.
INTERNAL: No. 72 Heald Siz., Hyd. feed, M.D.
No. 75 Heald; No. 52 Greenfield Hydroil (2), Hyd. feed, ball bearing spindle.
SURFACE: 15x15x96" Norton, M.D.; A.C. motor.
No. 11 Illinois, 6x24" table, M.D. with motor.
6x18" Norton Hydr.
TOOL & CUTTER: 2—No. 1 Wilmarth & Mormans, B.D.; one with Univ. Grinding att., one with head & Tailstock.
UNIVERSAL: No. 12 Cinc. Univ. 12x36", Self-Cont. M.D.; Bath, 10" swing, P.F. belt drive.

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24" Gisholt, 6½" hole
Foster Nos. 4, 5, 6, 1B, M.D.
W. & S. No. 4 Univ., M.D.
J. & L. 2¼x24", 3¼x36"
Acme 3¼x36" grd head

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Norton Hydraulic 12"x18", M.D.
Heald Nos. 55, 70, 72A3 Gagematic, M.D.
Norton 50"x28', M.D.
Gardner 72" disc, M.D.
Landis Type A 6x20", Hydraulic, M.D.
Bryant No. 12, M.D.
Nos. 50, 55, 60 Heald Int. Hydraulic, M.D.
B. & S. No. 3 Univ.
B. & S. No. 11, S.P.D.
12" Heald Rotary, M.D.

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McCabe 26-42"x14'
26"x24' Putnam 3 step cone, D.B.G.
24"x12' Boye & Emmes 3 step cone, D.B.G.
20"x14' Rahn-Larmon, raised to 24"
16"x8' Lodge & Shipley Grd. Hd., taper, M.D.
14"x6' Hendey, taper, collets
9' LeBlond Automatic
36"x30' Putnam, M.D.
36"x20' Putnam S.C.G., D.C. M.D.
36"x30' LeBlond, M.D.; 32"x35' Wickes M.D.
Putnam 42"x16' M.D.
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21"x14' Sidney Q.C.G.

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Cleveland Model A ½", ⅝", 1¼", 2"
Cleveland Model B, 1", 2"
Cleveland ⅞", Model M, 4 spindle
Gridley 4¼" single spindle, M.D.
P. & J. 6A, M.D.

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24"x24"x8' Cincinnati, 2 heads
36"x36"x8' Cincinnati, 3 heads
24"x24"x6', 1 head
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20", 24", G. & E.
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16", 20", 26" Stockbridge

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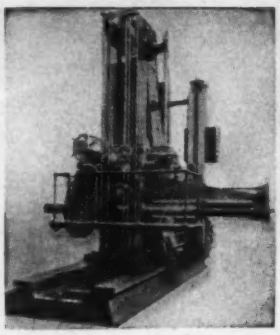

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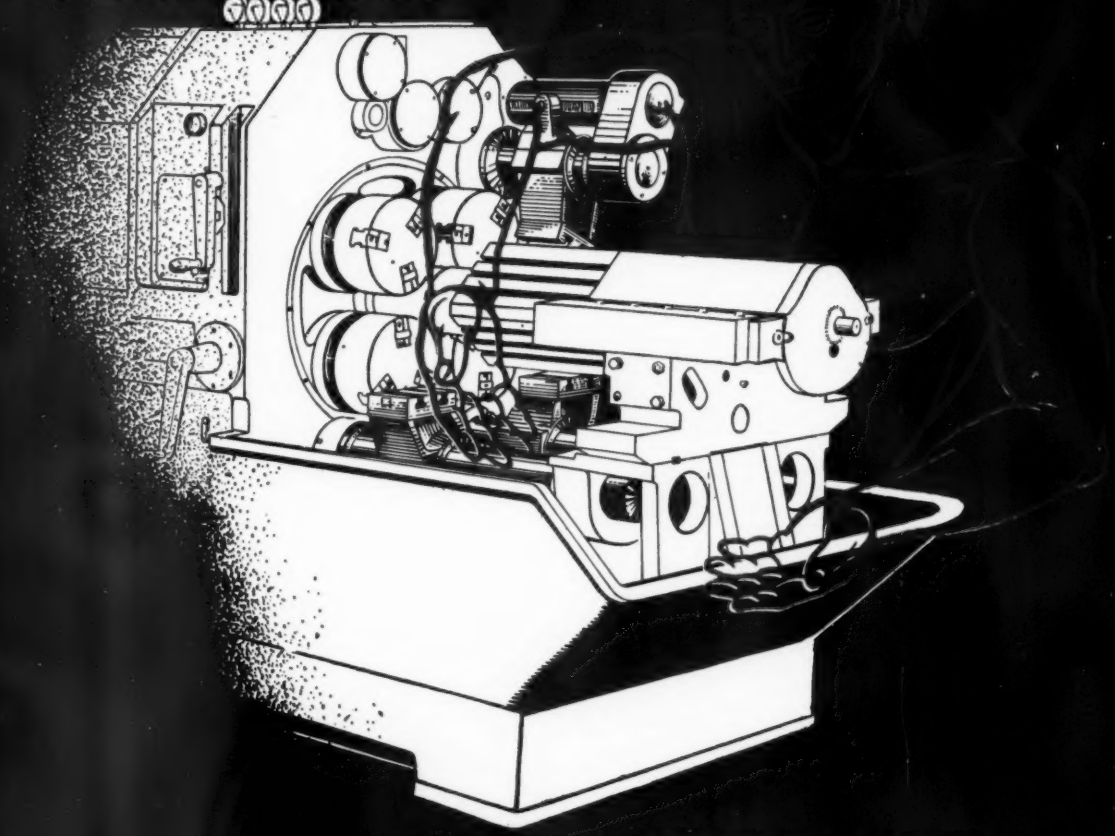

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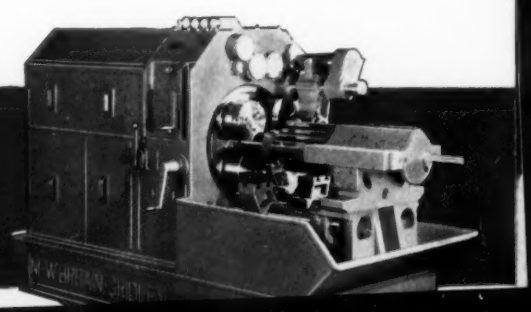

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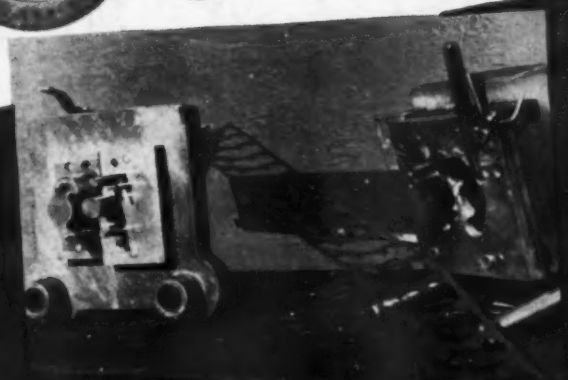

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